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PHYSICS ABSTRACTS

BEING

SCIENCE ABSTRACTS—SECTION A

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ABSTRACTS 1437–1709

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The language of an original article is indicated after the decimal number, unless the article is in English, thus: = 3 German, = 4 French, = 5 Italian, = 6 Spanish, = 82 Russian, = 956 Japanese.

MATHEMATICS

1437 511.4

On numbers of the form 2^a, 3^b. I. PILLAI, S. S. **II.** PILLAI, S. S., AND GEORGE, A. *Proc. Indian Acad. Sci. A*, 15, *pp.* 128–134, *Feb.*, 1942.

1438 512.8

Ideal theory in Boolean algebra and its application to deductive systems. PANKAJAM, S. *Proc. Indian Acad. Sci. A*, 14, *pp.* 670–684, *Dec.*, 1941.

1439 515.2

On a certain non-separating graph on an orientable surface. KAGNO, I. N. *J. Math. Phys.*, 20, *pp.* 370–387, *Dec.*, 1941.

1440 515.6

Preparation of perspective diagrams. HOBSON, G. D. *Nature, Lond.*, 149, *pp.* 209–213, *Feb.* 21, 1942.—To visualize 3-dimensional subjects from basic 2-dimensional contours, etc., perspective diagrams may be prepared from the basic diagrams, using a camera lucida or equivalent device. Examples given include mine workings, sets of spheres to show atomic structure, architectural features and various natural objects. Application to engineering mechanisms, layout of pipes, etc., is suggested. G. F. F.

1441 517.432 : 517.942.6 : 539.132

Exchange and spin. SCHRÖDINGER, E., AND HAMILTON, J. *Proc. Roy. Irish Acad. A*, 47, *pp.* 39–52, *Dec.*, 1941.—The object is to generalize to arbitrary spin number S, a remarkable identity between the operators of exchange and of spin which Dirac has established for $S = \frac{1}{2}$. A new proof of Dirac's relation is given. It is pointed out that the general analogue of the chemical compensation of spin in pairs is the compensation of spin in groups of $2S + 1$ particles. The "chemistry of spin S" consists in a bond acting not between pairs but (most efficiently) in groups of $2S + 1$. Something like the case $S = \frac{3}{2}$ seems to be realized between the heavy particles (proton-neutrons) in the nucleus. An appendix deals with double-spin algebra. H. H. HO.

See Abstr. 1485 517.433 : 531.392

1442 517.433 : 621.392.5

The transient behaviour of four-terminal networks. PIPES, L. A. *Phil. Mag.*, 33, *pp.* 174–214, *March*, 1942. —[Abstr. 808 B (1942)].

1443 517.513

Oscillations of the derivatives of a function. SCHAEFFER, A. C. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 62–64, *Feb.*, 1942.

1444 517.522

The coefficients of Stirling's series for log $\Gamma(x)$. UHLER, H. S. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 59–62, *Feb.*, 1942.

1445 517.61

Formulae connecting self-reciprocal functions. MOHAN, B. *Indian J. Phys.*, 15, *pp.* 337–341, *Oct.*, 1941.

1446 517.843

Generalized transformation theory of isothermal and dual families. KASNER, E., AND CICCO, J. DE. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 52–55, *Feb.*, 1942.

See Abstr. 1448 517.9 : 518.5

See Abstr. 1441 517.942.6 : 539.132 : 517.432

See Abstr. 1555 517.942.82 : 536.21

1447 518.3 : 541.25

Molal volume nomographs for aliphatic hydrocarbons. DAVIS, D. S. *Industr. Engng Chem.*, 34, *p.* 351, *March*, 1942.

1448 518.5 : 517.9

Mathematical theory of the differential analyser. SHANNON, C. E. *J. Math. Phys.*, 20, *pp.* 337–354, *Dec.*, 1941.—[See Abstr. 1058 (1932)].

1449 519.24

Studies in educational statistics. IV. A criterion of examination efficiency by the method of adjusted plot yields. SHINTRE, R. P. *Proc. Indian Acad. Sci. A*, 15, *pp.* 73–80, *Feb.*, 1942.

1450 519.264.4

Improved formulae for the coefficient of contingency. AYYANGAR, A. A. K. *Curr. Sci.*, 11, *p.* 51, *Feb.*, 1942.

1451 519.281

On the estimation of statistical parameters. AITKEN, A. C., AND SILVERSTONE, H. *Proc. Roy. Soc. Edinb. A*, 61, 2, *pp.* 186–194, 1942.

1452 519.52

Concerning separability. MOORE, R. L. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 56–58, *Feb.*, 1942.

ASTRONOMY

1453 521.13 : 539.132

Second-genus crossed orbits. BUCHANAN, D. *Canad. J. Res. A*, 20, *pp.* 11–24, *Feb.*, 1942.—The problem is to determine second-genus periodic orbits for the motion of two infinitesimal bodies that repel each other and are attracted by a third finite body. The forces of attraction and repulsion vary according to the Newtonian law of the inverse square. As the bodies are analogous to the normal He atom, the finite body is referred to as the nucleus and the infinitesimal bodies as the electrons. [See Abstr. 1490 (1932)].

1454 522.21

Aluminizing tank for the David Dunlap Observatory. YOUNG, R. K. *J. Roy. Astr. Soc. Can.*, 36, *pp.* 1–12, *Jan.*, 1942.—The construction of an evaporating chamber used for coating telescope mirrors with Al is sketched. The procedure used in leak-proofing the apparatus and preparing the Al coils for evaporation is fully described. A. HU.

1455 522.25

A yoke mounting for the 6 in. telescope. BRYDON, H. B. *J. Roy. Astr. Soc. Can.*, 36, *pp.* 17–24, *Jan.*, 1942.—The paper describes a cheap, stable, portable, equatorial mounting with setting circles and capable of being mechanically driven. The mounting is chiefly of cedar, with no special castings and few metal parts. A. HU.

1456 523.34

Possible atmospheric phenomena in the lunar crater Conon. VAUGHN, JR., F. *J. Roy. Astr. Soc. Can.*, 36,

pp. 49–54, *Feb.*, 1942.—Apparent changes suggesting local obscuration in this crater during each lunation are described. A "cloud" seems to move across the floor and to vary in size. A number of other reasons are suggested for believing that there may be a tenuous lunar atmosphere. A. HU.

1457 523.41

A composite light-curve of Eros. ROACH, F. E. *Astrophys. J.*, 95, *pp.* 310–312, *March*, 1942.—A composite light-curve of Eros from observations of 6 nights near the opposition of 1940 is represented by a theoretical curve based on Lambert's law of reflection and a geometrical figure of such dimensions that $Q_A : Q_B : Q_C = 1 : 4 : 13$, where Q_A, Q_B and Q_C, are the brightnesses of the asteroid as seen along its 3 principal axes. For the idealized case of a 3-axis ellipsoid this corresponds to a figure whose dimensions are 35 km., 15·6 km. and 7·2 km. Slight departures of the observations from the theoretical curve suggest asymmetries in the geometrical figure of the asteroid.

1458 523.72

The excitation temperature of the Sun. PROUSE, E. J. *Astrophys. J.*, 95, *pp.* 322–323, *March*, 1942.—The excitation temperature of the Sun was determined from measures of the central intensities of 6 lines of Ti 1 divided equally between two multiplets. The resulting values are $T = 4\,300°$ for the centre of the solar disc and $T = 4\,100°$ for the limb ($\cos\theta = 0{\cdot}26$). A comparison of the centre and limb observations indicates a decrease of line absorption coeff. rel. to the general absorption coeff. with increasing depth in the reversing layer.

1459 523.75

Recent solar observations in hydrogen and helium light. DODSON, H. W., AND DIJKE, S. E. A. VAN. *Astrophys. J.*, 95, *pp.* 325–327, *March*, 1942.

1460 523.8

The central density of the stars. LUYTEN, W. J. *Astrophys. J.*, 95, *p.* 327, *March*, 1942.

1461 523.83

Radial velocities of proper-motion stars. POPPER, D. M. *Astrophys. J.*, 95, *pp.* 307–309, *March*, 1942.—Radial velocities have been determined for 56 stars of large proper motion. Of these, 2 are white dwarfs, 35 are subdwarfs and 19 are main-sequence stars. New spectral types have been derived for all stars except the M dwarfs and the white dwarfs. For these, Kuiper's spectral types have been adopted. Five M dwarfs have been found to have the Ca lines *H* and *K* in emission.

1462 523.83

Atmospheric velocities in VV Cephei. GOEDICKE, V. *Astrophys. J.*, 95, *pp.* 319–321, *March*, 1942.—The M-type component is found to have no appreciable rotation around an axis at rt. angles to the plane of the orbit. A velocity of rotation corresponding to synchronism between orbital and rotational periods is excluded by the observations.

1463 523.841

Note on the periods of the variable stars in the globular cluster Messier 3. MARTIN, W. C. *Astrophys. J.*, 95, *pp.* 314–318, *March*, 1942.—The observations make possible a determination of the secular changes of period of the numerous cluster-type variables in M 3.

1464 523.87

Note on the spectrum of δ Sagittae. HYNEK, J. A. *Astrophys. J.*, 95, *pp.* 324–325, *March*, 1942.—From an examination of 14 spectrograms of δ Sagittae it appears likely that this star undergoes an atmospheric eclipse.

1465 523.87

Special problems of Be spectra. MERRILL, P. W. *Astrophys. J.*, 95, *pp.* 268–269, *March*, 1942.—Abstract of a paper presented at the Symposium on Astronomical Spectra held at the Yerkes Observatory, Sept., 1941.

1466 523.872

A determination of the energy distribution in the near infra-red spectrum of Vega. HALL, J. S., AND WILLIAMS, R. C. *Astrophys. J.*, 95, *pp.* 225–229, *March*, 1942.—A summary of results obtained (1941) at Amherst College Observatory. The energy of a carefully calibrated lamp was compared with that of Vega over a spectral region extending from 5 390 Å to 9 870 Å. The results indicate a colour temperature near 15 000°K. for the spectral region bounded by the visual region and the Paschen limit at 8 205 Å. Beyond this limit an excess of energy, about 0·23 mag., was found. The corresp. Balmer discontinuity is 1·22 mag.

1467 523.872

Spectrophotometry of 67 bright stars with a photoelectric cell: discussion. HALL, J. S. *Astrophys. J.*, 95, *pp.* 231–241, *March*, 1942.—[See Abstr. 2015 (1941)]. The influence of H absorption near the head of the Paschen series may be used to explain certain anomalies in the infra-red magnitudes of early-type stars. The apparent energy distributions of stars of different spectral types are compared with black-body distributions. Relative gradients were computed for all stars earlier than G5 and compared with those determined at Greenwich and Göttingen. The Amherst data indicate an effective wavelength of the *Harvard Revised Photometry* of 0·540 μ, the Sproul data suggest 0·534 μ. The weighted mean is 0·538 μ. Results of comparisons of ε Aur and α Per are presented. These show an abrupt increase in the infra-red energy of ε Aur just beyond the Paschen limit. This increase does not resemble that resulting from H absorption in A0 stars.

1468 523.872

Spectra of planetary nebulae of low surface brightness. MINKOWSKI, R. *Astrophys. J.*, 95, *pp.* 244–247, *March*, 1942.—A survey of 26 planetaries with low surface brightness shows, besides a number of objects strongly reddened by interstellar absorption, a high percentage of nebulae with either [O II] λ3 727 or He II λ4 686 strong. High intensity of λ4 686 is correlated with a low Zanstra temperature for the central star; such planetaries may be optically thin for the exciting radiation. The line 3 727 appears with the highest intensity on the outside of nebulae whose central stars have a high Zanstra temperature; this behaviour may be due to low density and the conditions of excitation on the outside of optically thick nebulae.

1469 523.877

The absorption coefficients of the free-free transitions of the negative hydrogen ion. WHEELER, J. A., AND WILDT, R. *Astrophys. J.*, 95, *pp.* 281–287, *March*, 1942.—The coeff. are evaluated throughout the visual range and the entire infra-red, on the basis of approx. calculation, and utilized for determination of the Rosseland mean of the mass absorption coeff. of H^- (sum of free-free and bound-free transitions) in the low-temperature range ($0{\cdot}8 < 5\,040/T < 2{\cdot}0$). These data set a lower limit to the opacity of late-type stellar atmospheres, pending the discovery of further absorption mechanisms likely to become relevant in the low-temperature range.

1470 523.877

The opacity in early-type stellar atmospheres. GREENSTEIN, J. L. *Astrophys. J.*, 95, *pp.* 299–306, *March*, 1942.—The theoretical absorption coeff. of H and of H^- ions have explained most of the phenomena of the continuous spectra of stars of early type. The present investigation of the possible effects of absorption by He and other light elements indicates that they can be neglected in normal stars. Unless He is abnormally abundant, it cannot substantially reduce the Balmer jump. The ratio of $\bar{k}/k_\nu$ is slightly increased by the admixture of He; the overlapping of the H lines near the Lyman limit is another source of such an increase.

1471 526.98

Construction of perspective drawings from contoured maps by means of a camera lucida. HOBSON, G. D. *Geol. Mag., Lond.*, 79, *pp.* 147–152, *March–April*, 1942.

1472 529.5

A perpetual calendar. ACHELIS, E. *J. Roy. Astr. Soc. Can.*, 36, *pp.* 25–31, *Jan.*, 1942.—Objections to the World Calendar are shown to be based on the doubtful claim for the unbroken continuity of the 7-day week. The author defends the stable perpetual calendar of 12 months and equal quarters, with one or two intercalary days. A. HU.

PHYSICS

1473 53 : 54

Physical tools in chemistry. KILLEFFER, D. H. *Rev. Sci. Instrum.*, 13, *pp.* 49–53, *Feb.*, 1942.

1474 530.12 = 4

Creation of particle pairs on the relativity theory. STUECKELBERG, E. C. G. *Helv. Phys. Acta*, 14, 7, *pp.* 588–594, 1941.—The fundamental points in connection with Einstein relativistic mechanics are outlined, and it is shown that it is possible on the basis of this scheme of mechanics to explain the creation of particle pairs without recourse to the quantum theory. A. J. M.

1475 530.12 : 530.145 = 4

Mechanics of a material particle in relativity and in quantum theory. STUECKELBERG, E. C. G. *Helv. Phys. Acta*, 15, 1, *pp.* 23–37, 1942.—The geodesic equation of motion of a material particle in Einstein's theory is arbitrarily modified by replacing the proper-time by another parameter and by additional terms to the equation. It is claimed that, by a suitable choice of these terms, creation of particles can be accounted for. The quantification of this type of mechanics is discussed. G. C. McV.

1476 530.12 : 538.3

Relativity theory of electromagnetism. CATTERMOLE, J. *Phil. Mag.*, 33, *pp.* 215–225, *March*, 1942.—A 5-dimensional manifold, whose coefficients are written down through the use of an analogy concerning the 4-dimensional definition of momentum, is stated to be the manifold appropriate for describing electromagnetic as well as gravitational phenomena. Neglecting gravitational forces, it is proved that a charged particle describes a circle, when acted on by a magnetic force, in the plane of the force. The motion of a charged particle in the field of a point-charge is a conic precessing in the plane of motion. The Larmor precessional velocity is deduced when the motion is under both an electrostatic charge and a magnetic field. G. C. McV.

1477 530.14 = 3

On the characteristic solutions of the Schrödinger deuteron equation. HULTHÉN, L. *Ark. Mat. Astr. Fys.*, 28 *A*, 5, [12 *pp.*], 1942.—A mathematical paper, dealing with the analytical treatment of the deuteron equation. A. J. M.

1478 530.145 = 3

Connections between Clifford numbers and spinors. MERCIER, A. *Helv. Phys. Acta*, 14, 7, *pp.* 565–573, 1941.—The properties of spinors are worked out, regarding them as the elements of a left- (or a right-) ideal of Clifford numbers. Both algebraic and geometric methods are used. G. C. McV.

See Abstr. 1475 530.145 : 530.12

See Abstr. 1604 530.145 : 539.15

1479 530.16 = 3

Rigid and statistical laws in physics and engineering. KUMMER, W. *Bull. Ass. Suisse Élect.*, 33, *pp.* 15–17, *Jan.* 14, 1942.—For hundreds of years causality and the laws of nature were regarded as identical terms, based on rigid laws. Recent development of physics showed the inadequacy of this view and introduced the conception of statistical probability. The philosophical implications of the new conception are briefly discussed and it is particularly emphasized that the application of the laws of probability do not represent the analysis of a chance but of a possibility and necessity. It is argued that all laws of nature are fundamentally statistical and that rigid laws represent only the one limiting case in which calculation predicts the result correctly in all cases without exception. R. H. G.

1480 531.19

Effusion phenomena in a degenerate Bose–Einstein gas. GOGATE, D. V., AND KATHAVATE, Y. V. *Phil. Mag.*, 33, *pp.* 310–314, *April*, 1942.

1481 531.223

Design diagrams for square concrete columns eccentrically loaded in two directions. ANDERSEN, P. *J. Amer. Concr. Inst.*, 13, *pp.* 149–163, *Nov.*, 1941.—The author gives 15 diagrams which will give directly, for square columns with symmetrical reinforcement and eccentrically loaded, the max. compressive stress on the concrete as well as the max. tensile stress in the reinforcement.

1482 531.224

Note on the bending of thin uniformly loaded plates bounded by cardioids, lemniscates, and certain other quartic curves. SEN, B. *Phil. Mag.*, 33, *pp.* 294–302, *April*, 1942.

1483 531.255.4

The solution of continuous beams of variable moment of inertia by arithmetical summation. OZANNE, W. A. *J. Instn Engrs Aust.*, 13, *pp.* 255–261, *Nov.*, 1941.—The method is based on the equation of 3 moments for continuous beams on unyielding supports, and the simultaneous equations obtained need only be solved once. The various summations required can then be made in tabular form. The results are sufficiently accurate for practical purposes if the number of divisions is 20 per span and if 5 positions of unit load, spaced evenly in each span, are chosen for the preparation of suitable tables. The use of the method is illustrated in the case of a 5-span bridge in Melbourne. G. E. A.

1484 531.311

A general theorem on the initial curvature of dynamical trajectories. KASNER, E., AND MITTLEMAN, D. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 48–52, *Feb.*, 1942.

1485 531.392 : 517.433

Operational analysis of non-linear dynamical systems. PIPES, L. A. *J. Appl. Phys.*, 13, *pp.* 117–128, *Feb.*, 1942.—An operational adaptation of a method developed by Lindsted and Liapounoff is presented, which is based on the Fourier–Mellin equations. The method may be used to solve certain types of non-linear differential equations, and to determine the free and forced vibrations of non-linear dynamical systems. The general procedure is shown in the case of an oscillating mass attached to a spring, and the fundamental frequency is expressed to various degrees of approximation, with the aid of a table of transformations. Other cases dealt with are: simple pendulum, electric circuit with inductance and condenser in series, oscillator non-linearly damped and forced non-linear vibrations. G. E. A.

1486 531.6 = 3

Brief note on the human attitude to the problem of matter *v.* energy. DESSAUER, F. *Helv. Phys. Acta*, 15, 1, *pp.* 108–110, 1942.—On the basis of Einstein's relation $E/c^2 = m$ the author compares corresponding mass and energy values in the case of (1) max. sensitivity in accurate weighing, (2) the ordinary 1 kg. weight, (3) sensitivity of hearing.

See Abstr. 1672 531.7 : 669 : 548

1487 531.7.081 : 535.23

The nature of temperature. BENHAM, W. E. *Proc. Phys. Soc., Lond.*, 54, *pp.* 121–128, *March*, 1942.—Evidence is adduced for the view that the ultimate significance of temperature is that it is measured by the thinness of a pulse of electromagnetic radiation. Remarks on a theory of radiation (which requires that central orbits shall be non-radiating when circular) are used to support a dimensional treatment in which the energy density of radiation is a function of the mass of an electron and of the abs. temperature.

See Abstr. 1673 531.71 : 669.1 : 548

1488 531.72 : 539.217 : 536.24

The calculation of the surface area of microporous solids from measurements of heat conductivity. KISTLER, S. S. *J. Phys. Chem.*, 46, *pp.* 19–31, *Jan.*, 1942.—The mean free path of silica aerogel has been calculated to be of the order of 8×10^{-6} cm. An equation is derived connecting m.f.p. in a microporous solid, like silica aerogel or xerogel, with the internal surface area. This permits accurate calculation of surface area from heat-conductivity data. The magnitude of the surface area so calculated was verified by adsorption measurements, and is $\rightarrow 3 \times 10^6$ cm.^{2}/g. An equation is derived to give variation in heat conductivity with density. The method enables length measurements to be made, 100 times smaller than the resolving power of the optical microscope.

1489 531.752

A recording automatic balance. EWALD, P. *Industr. Engng Chem. (Analyt. Edit.)*, 14, *pp.* 66–67, *Jan.* 15, 1941.

1490 531.761 : 621.317.39

Photoflash synchronizer tester. MARSAL, P. A. *Electronics*, 15, *pp.* 34–35, *Jan.*, 1942.—[Abstr. 773 B (1942)].

1491 531.787 = 3

Measurement of vapour pressure of reactive substances. (A new application of the separator tube.) FLEISCHMANN, R. *Naturwissenschaften*, 29, *pp.* 485–488, *Aug.* 8, 1941.—The measurement of the dependence on temperature of the v.p. of reactive substances is carried out in a modified separator tube [Abstr. 581 (1940)] filled with He; the lower end contains the substance, and an Hg manometer is attached to the upper end. The results are given for Br. The conc. along a separator tube in isolating substances of very different mol. wts. differs essentially from that of substances the mol. wts. of which are similar, as shown in a diagram. H. G. S.

1492 532.13

The viscosity of formamide-dioxane solutions at 5°, 25° and 40°. PARKS, W. G., LEBARON, I. M., AND MOLLOY, E. W. *J. Amer. Chem. Soc.*, 63, *pp.* 3331–3336, *Dec.*, 1941.—The results of measurements are compared with those of acetic acid, ethyl alcohol and water in formamide solutions. The variation of the density of pure formamide and pure 1,4-dioxane with temperature, the relationship between density and composition, viscosity and composition, are expressed by mathematical equations.

1493 532.13

The variation of viscosity of liquids with temperature. SRINIVASAN, M. K., AND PRASAD, B. *Phil. Mag.*, 33, *pp.* 258–271, *April*, 1942.—A number of equations connecting viscosity and temperature are examined. Andrade's simple equation is considered best for unassociated liquids. None of the equations can be applied to associated liquids, whose association changes rapidly with temperature.

1494 532.5 : 551.465 : 551.515.11 = 3

Recent contributions to the dynamics of atmospheric and oceanic currents. GÖRTLER, H. *Naturwissenschaften*, 29, *pp.* 473–479, *Aug.* 8, 1941.—A report of the methods and results of the work on flow research conducted at the Kaiser Wilhelm Institute, with 17 references. H. G. S.

1495 532.511 : 536.1

Corresponding problems in periodic and steady flow. II. GREEN, G. *Phil. Mag.*, 33, *pp.* 161–173, *March*, 1942.—The solutions given in Part I [Abstr. 1241 (1942)] provide a group of analogous results in heat conduction, steady fluid motion, electrostatics and other subjects to which the fundamental equation is applicable. The method is here employed in the case of flow past an infinite cylinder, and periodic-flow and continuous-flow solutions are found. The second case treated is that of flow past a sphere. The method is also applied to diffraction problems relating to flow through a circular aperture in a thin plane rigid wall. A solution of the steady flow, given by Lamb, is generalized and applied to the heat analogue to find the temperature distribution over the screen, in addition to the flow through the aperture. The solution of the corresponding periodic-flow problem is also given, and the case of the narrow rectangular slit is solved. G. E. A.

1496 532.542

The pressure wave system in the periodic flow of liquid in a pipe. SILVER, R. S. *Phil. Mag.*, 33, *pp.* 315–318, *April*, 1942.—Correction. [Abstr. 710 (1942)].

1497 532.57

The mechanical measurement of fluid flow. LADLEY, A. S. *J. Jr Instn Engrs*, 52, *pp.* 101–114; *Disc.*, 114–115, *Feb.*, 1942.—A descriptive account of various types of meter used commercially. The oscillating-piston type is now commonest, with gearing driving a clock train for registration. Notes on construction, installation, maintenance and accuracy, are included. E. H. W. B.

1498 532.57

Metering flow. ANNETT, F. A. *Power*, 86, *pp.* 69–88, *Feb.*, 1942.—Various forms of plant used in measuring, recording and integrating fluid flow commercially are described and illustrated. Among meters described are orifice-plate meters, pressure-drop, Venturi, electric flow, shunt, area, quantity and weir meters. J. S. G. T.

1499 532.582.6

Visual studies of flow patterns. HAUSER, E. A., AND DEWEY II, D. R. *J. Phys. Chem.*, 46, *p.* 212–213, *Jan.*, 1942.

1500 $532.59 + 535.82 + 535.230.8 + 538.247] = 3$

Some simple demonstration experiments. GREINACHER, H. *Helv. Phys. Acta*, 14, 7, *pp.* 552–558, 1941.

1501 532.61.08

Hydrometer-type float method for measuring surface and interfacial tensions. VONNEGUT, B. *Rev. Sci. Instrum.*, 13, *pp.* 82–83, *Feb.*, 1942.

1502 532.612.4

Molecular surface energy of sulphur dioxide addition compounds. I. BRIGHT, J. R., AND JASPER, J. J. *J. Amer. Chem. Soc.*, 63, *pp.* 3486–3488, *Dec.*, 1941.—The effect of temperature on the molecular surface energy of the readily dissociated addition compound of SO_2 with dimethylaniline, $C_6H_5(CH_3)_2N \cdot SO_2$, has been determined. Equations are presented for density and surface tension over the temperature range 0° to 30°.

1503 532.612.4

Measurement of surface tension and density by a modified capillary-rise method. TYLER, E. *Sch. Sci. Rev., No.* 90, *pp.* 159–165, *Feb.*, 1942.—External pressure is applied to the enclosed space above the meniscus. Both the elevation of the liquid in the capillary tube and the corresponding difference of liquid levels in an attached U gauge are measured by a projection method over a wide range. Calibration is effected by inserting a graduated glass scale in the plane previously occupied by the capillary tube. Linear equations involving surface tension and density are developed, suggesting graphical plotting.

1504 $532.612.4 = 3$

Dynamic and static surface tension of liquid bells. PALLASCH, R. *Ann. Phys., Lpz.*, 40, 6, *pp.* 463–480, 1941.—The dynamic surface tension of liquid bells is determined for water and for salt solutions of mol. conc. 175·36 g./l. [see Abstr. 3505 (1936)]. The dependence on the velocity of flow is established as a new result. An analytic equation of the liquid bells is derived and the results are discussed. [Abstr. 2871 (1935)]. H. G. S.

See Abstr. 1562 532.631 : 536.511

1505 532.71

Linkage of physico-chemical processes in biological systems. CONWAY, E. J., DONNAN, F. G. *Nature, Lond.*, 149, *p.* 383, *April* 4, 1942.—Correspondence.

1506 $532.77 : 536.412 : 551.25 : 551.463 : 551.510.3 = 3$

On problems of the so-called Uri Lloyd layer formation and its possible importance in oceanography, geology and meteorology. LIESEGANG, R. E. *Naturwissenschaften*, 29, *pp.* 395–396, *July* 4, 1941.—A short article showing the possible interpretation of the formation of strata in seas, minerals and the atmosphere, on the lines of the sharp horizontal bands that appear on heating an aqueous salt solution in which the conc. falls off very gradually from below upwards, the bands disappearing with full heating, to reappear when rapidly cooled, and to disappear on completing the cooling. H. G. S.

1507 532.77 : 536.7

The interaction between rubber and liquids. I. A thermodynamical study of the system rubber-benzene. GEE, G., AND TRELOAR, L. R. G. *Trans. Faraday Soc.*, 38, *pp.* 147–165, *April*, 1942.—Equations are developed relating the thermodynamic properties of a mixture of rubber + liquid with the v.p. of the liquid above the mixture. Experimental methods are described for the determination of v.p. over the whole range of composition. Complete v.p. data are given for rubber-benzene mixtures at 25°C. together with the calculated Gibbs' free energies of dilution and solution. Temperature-coeff. measurements at a number of conc. are employed to calculate heats of dilution, and these are interpolated by a modified form of an equation due to Langmuir. The entropy of dilution is approx. twice the heat of dilution over a wide conc. range, and, except in dilute solutions, both are independent of the mol. wt. of the rubber. The entropy of dilution is larger than its ideal value and can be approx. represented by an equation due to Flory.

1508 532.77 : 539.133

Some properties of solutions of long-chain compounds. HUGGINS, M. L. *J. Phys. Chem.*, 46, *pp.* 151–157, *Jan.*, 1942.—By statistical treatment, equations are derived for the activities of the components of a solution containing both chain molecules and small (non-chain) molecules. Using these activity equations, relations are discussed for the osmotic pressure, the lowering of f.p. and the solubility.

1509 533.6.013.42

On propeller-tip interference due to the proximity of a fuselage. GAIL, A., AND LU HO-SHEN. *J. Aero. Sci.*, 9, *pp.* 11–16, *Nov.*, 1941.—The periodic changes of the air forces acting on a propeller blade element that passes by the flanks of a fuselage nose are theoretically investigated. This forcing function, known to excite vibrations of propellers and aeroplane structure, is harmonically analysed. The farther downstream the propeller is located behind the fuselage tip and the greater the fuselage dia. compared with the propeller dia., the smaller is the intensity of the fundamental harmonic and the smaller is the relative importance of the higher harmonics of these propeller-tip excitations. The clearance has little effect.

1510 533.723 : 539.219 = 3

Experiments on the mobility of foreign molecules in swollen and in elastically solid rubber. KUHN, W., SUHR, H., AND RYFFEL, K. *Helv. Phys. Acta*, 14, 7, *pp.* 497–506, 1941.—A movement of foreign molecules has been established both in benzene-swollen and in solvent-free, elastically solid rubber, and their diffusion const. have been approx. evaluated. The latter declined with increase of mol. wt. from 500 to 1 200 by a factor of 1·5 to *c.* 200. The diffusion const. for phenol in solvent-free rubber is *c.* 10^{-11}, i.e. about 10^6 times smaller than in swollen rubber. An orientation of dissolved coloured chain molecules has been established by optical experiments on stretched rubber, which show that in one and the same substance movements of foreign molecules can occur which vary to a wide degree. It follows that, for interpretation of the relaxation-time spectrum, the elastic and viscous properties of the substance are very important. H. H. HO.

1511 534.1 : 539.32

Determination of the static and dynamic constants by means of response curves. BERNHARD, R. K. *J. Appl. Phys.*, 13, *p.* 116, *Feb.*, 1942.—Correction. [Abstr. 717 (1942)].

1512 534.21 = 3

Directed sound. The theoretical principles of the directional transmission and reception of sound waves and their practical application to problems of sound propagation in free media. FISCHER, F. A. *Naturwissenschaften*, 29, *pp.* 138–146, *March* 7, 1941.—A comprehensive survey of technical acoustics in the domain of signalling and sound location, particularly for navigational and military purposes. The group principle, with or without artificial phase displacement, is the only system which has led to the successful solution of the problems involved. It is explained, and is exemplified by a few typical sound transmitters for operation in air and under water. A compensator for sound in water is also illustrated and briefly described. H. G. S.

1513 534.22 : 541.68 = 3

On the velocity of sound and constitution in organic liquids. SCHAAFS, W. *Ann. Phys., Lpz.*, 40, 6, *pp.* 393–404, 1941.—[See Abstr. 1696 (1938)]. On the basis of the van der Waals equation of state it is shown that the different and apparently contradictory observations can be explained in a simple manner. Selected examples and new values of the velocity of sound are given. H. G. S.

1514 534.414 = 3

The fine structure of the resonance curves of acoustic resonators. ZICKENDRAHT, H. *Helv. Phys. Acta*, 14, 7, *pp.* 525–536, 1941.—Different forms of resonator were tested by means of sensitive flames. The sound source employed was a calibrated tone generator which actuated a loud-speaker. The intensities lay between 80 and 100 phon, and the contraction of the flame was approx. $\propto$ nbr. of phons. A cylindrical resonator of length 5·54 cm. and i.d. 9·50 cm. with circular opening 1·0 cm. dia. and 0·3 cm. length gave 9 resonance frequencies, a spherical resonator gave 14 and a Helmholtz resonator 17. In tests of open cylindrical pipes the occurrence of a similar fine structure was observed. In discussing the causes of the fine structure it was considered that the partial resonances along with the asymmetrical gas currents at the mouth of the resonator favoured the production of difference tones between the inharmonic overtones of the resonator. G. E. A.

1515 534.647 : 550.341

The Oldham seismograph station at Utah State Agricultural College, Logan, Utah. WILLIAMS, J. S. *Bull. Seism. Soc. Amer.*, 32, *pp.* 49–59, *Jan.*, 1942.

1516 534.811

On the calibration of the Wenner seismograph. WORRELL, F. T. *Bull. Seism. Soc. Amer.*, 32, *pp.* 31–48, *Jan.*, 1942.—The five intrinsic const. of both the galvanometer and seismometer of the Pittsburgh seismometers were obtained from experimental results. From these const. the performance of the galvanometer-seismometer system was calculated for a period of 10 sec. and critical damping for operation conditions. The experimental procedure follows that of Robison and McNish for the U.S. Coast and Geodetic Survey stations. R. S. R.

1517 535.135 = 3

Bringing the electromagnetic theory of reflection and refraction into conformity with the physical processes. SCHRIEVER, O. *Ann. Phys., Lpz.*, 40, 6, *pp.* 448–462, 1941.—The representation of damping by a complex refractive index is shown to be insufficient, especially at oblique incidence. The theory is developed anew from predominantly physical standpoints. In the intensity formulae both the real and the complex indices of refraction occur together; at vertical incidence the complex index alone remains. H. G. S.

See Abstr. 1574	535.2 : 537.531
See Abstr. 1600	535.215.1 : 538.565
See Abstr. 1487	535.23 : 531.7.081
See Abstr. 1500	535.230.8
See Abstr. 1589	535.234 : 537.533.79

1518 535.24 : 535.6 = 3

Remark on the connection between photometry and colorimetry. KÖNIG, H. *Helv. Phys. Acta*, 14, 7, *pp.* 559–564, 1941.—An attempt is made to interpret the connection between photometry and colorimetry in the Abney equation and to indicate its numerical validity. H. G. S.

See Abstr. 1549 535.24 : 535.62 — 291

1519 535.245

Brightness and brightness meters. TAYLOR, A. H. *Illum. Engng, N.Y.*, 37, *pp.* 19–30, *Jan.*, 1942.—Discusses the Purkinje effect in the measurement of low values of brightness, and proposes to express brightness for all colours on the scale obtained by visual comparison with the physical scale established in white light (tungsten filament lamp). Various forms of brightness meters are described, including the instrument designed by the author for measuring a wide range of low values of brightness, viz. $0{\cdot}1$ to 5×10^{-6} foot-lamberts [see Abstr. 1052 (1942)]. J. W. T. W.

See Abstr. 1575–1578 535.3 : 548 : 537.531

See Abstr. 1579 535.3 : 548.73 : 537.531

1520 535.312

Some characteristics of metal mirrors and a new gonioreflectometer. BENFORD, F., AND RUGGLES, W. A. *J. Opt. Soc. Amer.*, 32, *pp.* 174–184, *March*, 1942.—Tests on over 100 mirrors of 37 kinds were made of specular reflectance at angles from 15° to 82·5°, and a new gonioreflectometer was built. The angular distribution data were used to compute average reflectances, in 3 different manners, representing 3 different points of view. A number of alloys of Al were made and tested, and the entire group of mirrors was retested to determine the degree of permanence.

1521 535.319 : 77

Rectification of a negative made on an inclined plate. LEE, H. W. *Photogr. J.*, 82, *pp.* 74–76, *March*, 1942.—Discusses the method of correcting converging perpendiculars in the enlarger by the use of a sloping negative in conjunction with an inclined easel. The subject is dealt with theoretically and the conclusion reached that distortion can only be avoided by reduction from the negative. A. H.

1522 535.33

Curve shape index for identification by means of spectrophotometric curves. SHURCLIFF, W. A. *J. Opt. Soc. Amer.*, 32, *pp.* 160–163, *March*, 1942.

1523 535.33.03

A new source for infra-red spectrometers. SMITH, L. G. *Rev. Sci. Instrum.*, 13, *pp.* 63–64, *Feb.*, 1942.—A source consisting of a carbon rod heated electrically in vacuum is described. Ground with a V-shaped cavity 1 in. long in the centre, a 6 mm. dia. rod has been operated at 1 800°C. with a power consumption of 600 W and a lifetime of 100 hr.

1524 535.33.03 = 3

The spectral analysis of inclusions. THANHEISER, G., AND HEYES, J. *Naturwissenschaften*, 29, *pp.* 488–492, *Aug.* 8, 1941.—The analysis is carried out with the aid of a spark passed through a very fine hole in an insulator (mica) on the surface of the specimen to be investigated. The hole was made with a boring needle with a point 0·01 mm. dia., the construction of which is given. Reproductions of the spectra of inclusions in steel and several iron ores show the utility of the method as a means of determining the nature of the constituents of alloys, minerals, etc. H. G. S.

1525 535.33.07

A new large two-lens quartz spectrograph of compact design. JACOBSOHN, S. *J. Opt. Soc. Amer.*, 32, *pp.* 164–167, *March*, 1942.—A 2-lens instrument is described which is as compact as the Littrow and which obviates back reflection from the lens surface. After refraction of the light by a 60° prism the radiation is collected by the camera lens, thrown on to an aluminized plate which then sends it on to the photographic plate. The layout of the spectrograph is similar to that of the Littrow and, apart from overcoming the reflection trouble, it is claimed that astigmatism and doubling are much less than with the Littrow. A. H.

1526 535.33.07

A recording echelette grating spectrometer for the near infra-red. SMITH, L. G. *Rev. Sci. Instrum.*, 13, *pp.* 54–62, *Feb.*, 1942.—A new prism-grating spectrometer employing replica echelette gratings and capable of resolving lines from $0{\cdot}3$ cm.$^{-1}$ to $1{\cdot}0$ cm.$^{-1}$ apart in the region 1–25 μ is described. Careful shielding and construction of a stable amplifier have so reduced zero unsteadiness as to make possible the direct recording of galvanometer deflections. Atmospheric absorptions have been almost eliminated by circulation of the air in the spectrometer box over chemicals contained in separate boxes.

1527 535.331

The explosion spectra of some metals. VENKATESHA, S. *J. Mysore Univ.*, 2, 8, *pp.* 55–60, 1941.—Lines enhanced in explosion spectra as compared with low-current arcs are arc lines, those suppressed or absent belong to the spark spectrum. More lines are shown in reversal in the explosion spectra than in the low-current arc. The continuous spectrum is as a rule stronger in the explosion spectrum. In the case of Al, sharp series lines hitherto unobserved are seen in absorption. The persistent lines due to traces of elements present as impurity are much brighter in the explosion spectrum. In some cases impurities are revealed which cannot be detected in the low-current arc. A. H.

1528 535.337

Effect of temperature on the intensities of Raman lines. I. Crystals. VENKATESWARLU, K. *Proc. Indian Acad. Sci. A*, 14, *pp.* 529–534, *Nov.*, 1941.—The dependence of intensity on temperature of the Raman lines, 465 in crystalline quartz, 315 in $HgCl_2$, and 1 065 in a $NaNO_3$ crystal, has been experimentally studied. Sharp disagreements with the existing theories have been noticed in individual intensities of the Stokes and the anti-Stokes lines at different temperatures. The observed ratio of the intensity of the Stokes line to that of the corresponding anti-Stokes line at different temperatures conforms closely to existing theories.

1529 535.338

Rydberg corrections for *D*-terms in He I. PINCHERLE, L. *Phys. Rev.*, 61, *pp.* 156–157, *Feb.* 1 *and* 15, 1942.—The interaction between the normal 1*snd*- and

the $2p2p$-configuration in He I is evaluated, and its contribution to the difference between the Rydberg corrections of the ortho- and para-terms is found to be large. As a consequence, the theoretical values for these differences result too small.

1530 535.338

Theory of complex spectra. I. RACAH, G. *Phys. Rev.*, 61, *pp.* 186–197, *Feb.* 1 *and* 15, 1942.—This paper gives a closed formula which entirely replaces, for the 2-electron spectra, the previous calculations with the diagonal-sum method. Applications are made to some configurations with 3 or more electrons and to the p^n configurations of the nuclei.

1531 535.338 : 538.615

First spark spectrum of neodymium—preliminary classification and Zeeman-effect data. ALBERTSON, W. E., HARRISON, G. R., AND MCNALLY, JR., J. R. *Phys. Rev.*, 61, *pp.* 167–174, *Feb.* 1 *and* 15, 1942.—Classification by means of the combination principle of 367 lines of Nd II as arising from 30 lower and 57 upper levels was checked by Zeeman-effect measurements up to 87·180 oersteds, and by other data. Quantum numbers are assigned to those levels which have approx. *LS* coupling, and *g*-values of all known levels determined. The strongest lines belong to the sextet and quartet super-multiplets arising from the transition $4f^4(^5I)6p$–$6s$, but these show perturbations which give rise to intensity anomalies.

1532 535.338 : 541.65 = 3

On the assignment of electronic bands in spectra of solutions. V. KORTÜM, G. *Z. phys. Chem. B*, 50, *pp.* 361–381, *Nov.*, 1941.—[See Abstr. 2628 (1941)]. The investigations were carried out with aliphatic and aromatic azo- and diazo-compounds and their derivatives. The relations found for location and intensity of the bands allow of establishing the degree of participation of certain boundary formulae in accordance with the chemical behaviour of the molecules, e.g. their basicity. R. N.

1533 535.338 : 548 = 3

Proof of the chain vibrations of solid dicarboxylic acids in the infra-red spectrum. WEHRLI, M. *Helv. Phys. Acta*, 14, 7, *pp.* 516–524, 1941.—By means of the theory of chain vibrations, the vibrations for the crystal molecules of oxalic, malonic, succinic and glutaric acids have been quantitatively determined between the wave numbers 650 and 950 cm.$^{-1}$. The valency angle of malonic acid is 108°. In succinic acid the 4 C atoms are at the corners of an oblique tetrahedrón with a valency angle of 72°, in agreement with X-ray measurements. The valency vibration frequencies depend only slightly on the rotations about the C–C– directions. The const. for the C–C– bonds of both molecules are $3{\cdot}9 \times 10^5$ dyne/cm. The displacement of the whole chain-frequency band of the valency vibrations for the range 750–1 050 cm.$^{-1}$ of liquid paraffin to the range 680–950 cm.$^{-1}$ of crystalline dicarboxylic acids depends essentially on the mass differences of the end-groups CH_3 and COOH and less on the different states of aggregation. H. H. HO.

See Abstr. 1674 535.338 : 548

See Abstr. 1659 535.34 : 541.182.6

1534 535.343

An infra-red absorption cell for gases at high and low temperatures. SMITH, L. G. *Rev. Sci. Instrum.*, 13, *pp.* 65–67, *Feb.*, 1942.—A cell which may be run from − 100°C. to + 200°C. is described. Made of monel metal, the cell is sealed with rocksalt windows fastened to thin Pb end plates with glyptal. The cell is heated by a coil wrapped around it and cooled by air from a reciprocating pump immersed in a low-temperature bath or liquid air.

1535 535.343

An improved source for the Lyman continuum in the vacuum ultra-violet. WORLEY, R. E. *Rev. Sci. Instrum.*, 13, *pp.* 67–71, *Feb.*, 1942.—The mechanical difficulties are avoided by use of a replaceable quartz capillary held in permanent alignment by a metal clip, and of a fin-type electrode that effectively prevents clogging of the spectrograph slit even for widths as narrow as 0·02 mm. Features of the operation are discussed.

1536 535.343.2

Raman effect in deutero-nitric acid. BANERJI, G. B., AND MISHRA, B. *Indian J. Phys.*, 15, *pp.* 359–363, *Oct.*, 1941.—Deutero-nitric acid has been prepared by the action of nitrogen pentoxide on heavy water. The Raman spectra of the acid have been photographed and consist of frequencies 166, 589, 667, 790, 905, 1 017, 1 293, 1 536, 1 640, 1 849, 1 972 and 2 455 (band). By comparison with HNO_3 it has been found possible to calculate the isotope shifts and to explain the origin of the vibrations in DNO_3.

1537 535.343.9

Optics in sabotage and espionage. DRISCOLL, W. G. *J. Opt. Soc. Amer.*, 32, *pp.* 134–138, *March*, 1942.

See Abstr. 1648 535.37 : 541.141.1

1538 535.371

Some aspects of fluorescence. RADLEY, J. A. *J. Soc. Dy. Col., Bradford*, 58, *pp.* 49–51, *March*, 1942.—Any source of ultra-violet radiation can be used, and in general a nickel oxide glass is used to cut out visible light. Mixtures of fluorescent substances are often separated by capillary analysis prior to examination under the lamp. Short paragraphs deal with the photography of fluorescent effects, microscopy, secondary fluorescence, which embraces a technique whereby the fluorescence of a substance is changed in a specific manner by staining, volumetric analysis, fluorescent lighting and scenic effects. H. H. HO.

1539 535.371

Reversible quenching by oxygen of the fluorescence of polycyclic hydrocarbons. WEIL-MALHERBE, H., AND WEISS, J., BOWEN, E. J. *Nature, Lond.*, 149, *pp.* 471–472, *April* 25; 528, *May* 9, *and p.* 612, *May* 30, 1942.—Correspondence.

1540 535.371

Fluorescence reactions with boric acid and O-hydroxy-carbonyl compounds, and their application in analytical chemistry. NEELAKANTAM, K., AND ROW, L. R. *Proc. Indian Acad. Sci. A*, 15, *pp.* 81–88, *Feb.*, 1942.

See Abstr. 1586 535.4 : 537.531.85 : 537.533.73

1541 535.428

New methods in the study of light scattering. I. Basic ideas. II. Pure liquids. RAMAN, C. V., AND BALAKRISHNAN, T. A. S. *Proc. Indian Acad. Sci. A*, 14, *pp.* 228–241, *Sept.*, 1941.—The character of the polarization of the light scattered transversely from a

beam of polarized light varies with the plane of polarization of the primary beam and conclusions can be drawn with respect to size, form and anisotropy, of the scattering particles. Raman proposes a Babinet compensator to study the polarization. This method is sensitive and applicable in the ultra-violet. Light scattered in dust-free liquids is not always completely unpolarized when the incident light is polarized with its vibration in the plane of observation. CCl_4 and ether show a slight polarization, but benzene gives no effect. W. S. S.

1542 535.43

Radiation forces in Compton effect. NEMIROVSKY, P. E. *J. Phys., U.S.S.R.*, 4, 6, *pp.* 555–562, 1941.—The reaction of radiation is taken into account in the process of Compton scattering of light by the use of Heitler electrodynamics. The interaction energy is assumed to involve the electromagnetic potentials linearly. An exact solution of the equations is obtained though processes of order higher than the third are neglected. The influence of the reaction of radiation is unimportant. G. C. McV.

1543 535.43 : 535.5 : 541.182.63

The depolarization of the Tyndall-scattered light of bentonite and ferric oxide sols. HOOVER, C. R., PUTNAM, F. W., AND WITTENBERG, E. G. *J. Phys. Chem.*, 46, *pp.* 81–93, *Jan.*, 1942.—Simple apparatus, based on the Cornu method and capable of giving accurate and reproducible results, has been devised for the determination of the degree of depolarization of the transversely scattered light of colloidal dispersions. This apparatus may be utilized to follow changes in particle size, anisometry, and anisotropy. Series of monodispersions of bentonite and ferric oxide were prepared by Hauser's method, while polydisperse sols of ferric oxide required special technique of hydrolysis and dialysis of pure ferric chloride and nitrate. Depolarization values are not valid unless duplicable at different dilutions, and conc. above 0·1% introduce multiple scattering. The Krishnan relationship is valid for these sols, whether oriented or not by an electrical field, while anisometry does not greatly affect depolarization values for dielectric colloids. The ratios X/Z and Δ_v/Δ_H are a measure of particle size, where these are derived from components of the scattered light. H. H. HO.

1544 535.430.7

A photo-electric turbidimeter for use in solution kinetics. TOMPKINS, F. C. *Trans. Faraday Soc.*, 38, *pp.* 128–131, *April*, 1942.—A turbidimeter has been devised for following the course of a precipitation reaction.

1545 535.435

Scattering of light in binary liquid mixtures. RAO, D. V. *Proc. Indian Acad. Sci. A*, 15, *pp.* 24–34, *Jan.*, 1942.—Various theories, explaining the fact that, in the scattering of light in binary mixtures, ρ_h, the ratio of the horizontal to the vertical component, is usually < 1, are discussed. The scattering of light by a mixture of CS_2 and CH_3OH has been studied, the isothermal variation with concentration of the depolarization factors ρ_a, ρ_v and ρ_h, being determined. There is evidence for the existence of molecular clusters in the critical composition mixtures at ordinary temperatures, which is supported by investigation of the rotational Raman effect. ρ_h depends on the shape and not on the size of the volume of liquid illuminated. Expressions obtained by others for the relation between ρ_v and ρ_h and the angle of convergence of the incident light are verified for pure liquids. In the critical mixture convergence causes ρ_h to become < 1. A. J. M.

See Abstr. 1543 535.5 : 541.182.63 : 535.43

1546 535.515

On the polarization of light scattered by optical glasses. PARTHASARATHY, S., SIRKAR, S. C., AND NIYOGI, K. C. *Proc. Nat. Inst. Sci. India*, 7, 3, *pp.* 247–255, 1941.—The ratio of the intensities of the vertically and horizontally polarized components of the light transversely scattered by 4 cubes of optical glass was determined for vertically polarized, horizontally polarized and unpolarized incident light. For horizontally polarized incident light, the ratio nearly = 1 [see Abstr. 1185 (1939)]. Two of the cubes were in a state of internal strain, as shown by their birefringence, and might be expected to give other values for the ratio than the unstrained specimens. W. S. S.

1547 535.6

X–Z planes in the 1931 I.C.I. system of colorimetry. ADAMS, E. Q. *J. Opt. Soc. Amer.*, 32, *pp.* 168–173, *March*, 1942.—A discussion of methods of plotting. A. H.

See Abstr. 1518 535.6 : 535.24

1548 535.62 — 291

The whiteness of cinema screens. HALLETT, C. G. H. *Proc. Phys. Soc., Lond.*, 54, *pp.* 98–109, *March*, 1942.

1549 535.62 — 291 : 535.24

The measurement of near-whites in the paper industry. HARRISON, V. G. W. *Proc. Phys. Soc., Lond.*, 54, *pp.* 86–98, *March*, 1942.

1550 535.62 — 291 : 535.733

The nature and measurement of whiteness. HOLMES, J. G. *Proc. Phys. Soc., Lond.*, 54, *pp.* 81–86, *March*, 1942.—The uniqueness of white is discussed from the visual and colorimetric points of view. The sensitivity of the eye to departures from white are considered, together with the extent to which the visual mechanism compensates for changes in illumination. Instrumental methods for the measurement of whiteness are given.

See Abstr. 1550 535.733 : 535.62 — 291

See Abstr. 1500 535.82

1551 536 = 3

Progress of research in heat technology. SCHMIDT, E. *VDI [Z. Ver. dtsch. Ing.]*, 86, *pp.* 135–136, *March* 7, 1942.—[See Abstr. 764 (1942)]. A collection of brief abstracts of papers read at the 16th meeting of the V.D.I. committee on heat research. The following subjects were dealt with: On the question of measuring units in technical thermodynamics, Schmidt, E.; A new equation of state for vapours, Eichelberg, G.; Composition of waste gases dependent on composition of fuel and mixing ratio, Richter, L., and Klemmetmüller, R.; Regularities in the calculation of sp. ht. of liquids, Riedel, L.; Instruments for measuring piezo-electric pressure for the thermo-

dynamic examination of motors, Ullmann, K.; Suggestions for fundamental research on gas-analytic heat-conductivity instruments, Engel, F. V. A.; Heat radiation in superheaters, Seidel, H.; Experiments with a model cooler, Schiller, L.; On the ratio of the exchange values at the exchange of heat and impulse, Reichardt, H.; Heat transfer in the boundary layer of swept bodies, Eckert, E.; Completion of the theory of heat exchange in regenerators, Hansen, H.; A new optical interference method for measuring the diffusion constants of fuel vapours in gases, Schmidt, E.; Heat transfer at condensation with turbulent water film, Grigull, U. R. N.

See Abstr. 1495 536.1 : 532.511

1552 536.2.02

A problem in two-dimensional flow. MACEY, H. H. *Proc. Phys. Soc., Lond.*, 54, *pp.* 128–134, *March*, 1942.—A method of solving a case of 2-dimensional heat-flow equation is given and used to calculate the distribution of moisture content in a clay cylinder drying from its curved surface only. The results of such calculations are compared with experimental data.

1553 536.21

An investigation of the temperature gradients established in refractory blocks during their firing. PRESTON, E., AND TURNER, W. E. S. *J. Soc. Glass Technol.*, 25, *pp.* 310–327, *Dec.*, 1941.—The time/temperature curves obtained showed that, when heat is applied intermittently, there is neither a smooth temperature rise, nor uniformity of temperature gradient between different parts of a block in the firing process; and these parts finally attain a temperature controlled by their location within the furnace, so that a natural temperature gradient becomes set up which prolonged soaking cannot remove.

1554 536.21

Heating curves. OLSON, F. C. W., AND JACKSON, J. M. *Industr. Engng Chem.*, 34, *pp.* 337–341, *March*, 1942.—Methods of plotting and describing heating curves are given. The parameters of experimental heating curves are identified with terms in the theoretical equation. The effect of thermal diffusivity, shape and initial temperature distribution, on the parameters of the heating curve are discussed for various points in the object being heated.

1555 536.21 : 517.942.82

Heat conduction in a semi-infinite slab. MERSMAN, W. A. *Phil. Mag.*, 33, *pp.* 303–309, *April*, 1942.—The problem is that of heat conduction in a semi-infinite slab whose initial temperature distribution is known, when the temperature gradient at the face is a known function of time. A purely formal solution is obtained, using Laplace transformations and Riemann integrals. Substituting Lebesgue integrals, the solution is completely established. Two special cases are treated.

1556 536.212

Thermal conductivity of some industrial materials. GRIFFITHS, E., POWELL, R. W., AND HICKMAN, M. J. *J. Inst. Fuel*, 15, *pp.* 107–120, *April*, 1942.—Thermal conductivity methods are described and results given for refractories, insulating bricks, granular and fibrous materials, mica, carbon, graphites and metals. The settlement under load of slag wool in a cavity wall is determined. Certain phlogopite micas undergo a marked decrease in conductivity at about 200°C., and X-ray examination confirms that at this temperature the originally perfect crystal disintegrates into a number of tilted elements. Impurities have a lesser effect on the conductivity of iron at high than at low temperatures, and at any one temperature the conductivity values of various steels lie on a smooth curve when plotted against the total equivalent carbon content. Carbon has a low conductivity, but at normal temperatures the conductivity of one sample of natural graphite exceeded that of copper. The possibility of deriving the thermal conductivity of a metal from its electrical resistivity is considered. R. W. P.

1557 536.212 : 537.323 : 538.66 = 3

Investigation of the dependence on temperature of thermal conductivity and thermo-e.m.f.s in metals and on the validity of the additive law of heat resistance. KOHLER, M. *Ann. Phys., Lpz.*, 40, 1, *pp.* 1–16, 1941.—A rigorous solution is given of the statistical fundamental equation (valid over the whole T range) for an isotropic or single-valued conductor in the strong transverse magnetic field. No account is taken of lattice conduction, nor is disturbance of the distribution of the thermal lattice waves due to temperature gradient and electron interaction considered. Expressions are derived for the heat resistances and e.m.f.s of the pure metal over the whole temperature range. As the isotropic conductor at the higher temperatures shows no change in heat resistance in the magnetic field the resulting formula for the heat resistance in the strong transverse field at high temperatures must agree with the value without magnetic field. Similarly for the thermo-e.m.f.s. [See also Abstr. 1900 (1941)]. H. G. S.

See Abstr. 1488 536.24 : 539.217 : 531.72

1558 536.244

Heat transfer of condensing organic vapours. COOPER, A. H., MORRISON, R. H., AND HENDERSON, H. E. *Industr. Engng Chem.*, 34, *pp.* 79–84, *Jan.*, 1942.—An attempt is made to determine and correlate the film heat-transfer coeff. for vapours condensing on a vertical surface. This investigation included alcohols and acetates. Five members of each of these series, and a constant-boiling mixture of ethyl acetate-isopropyl alcohol and an immiscible liquid mixture of steam and butyl acetate, were studied. Members of each of the organic series investigated fell in parallel curves, the film coeff. decreasing with increasing mol. wt. The film coeff. of the condensing immiscible liquid mixture fell intermediate between the 2 pure components, while that of the azeotropic mixture appeared to be higher than either of the individual components.

See Abstr. 1684 536.4 : 539.214 : 548.73

See Abstr. 1506 536.412 : 551.25 : 551.463 : 551.510.3 : 532.77

See Abstr. 1563 536.413 : 536.511

1559 536.423 : 541.24 = 3

On a method of determining the molecular weights of evaporating particles. MIESCHER, E. *Helv. Phys. Acta*, 14, 7, *pp.* 507–515, 1941.—The velocity and pressure of evaporation were measured for evaporating surfaces of ice and sulphur in a high vacuum

by an electrical balance. The mol. wts. of the evaporating particles were calculated. Simple and non-associated H_2O-molecules appear to evaporate from ice surfaces, whereas the results for sulphur were slightly lower than an 8-atomic molecule.

H. H. HO.

1560 536.48

Effects of low temperatures on neoprene vulcanizates. YERZLEY, F. L., AND FRASER, D. F. *Industr. Engng Chem.*, 34, *pp.* 332–336, *March*, 1942.—Several test procedures for determining the freeze resistance of rubberlike materials are described and discussed. The use is illustrated by a comparison of the freeze resistance of rubber, neoprene type GN and neoprene type FR vulcanizates.

1561 536.511

An experimental study of the absolute temperature scale. VI. The gas thermometer assembly and the experimental method. BEATTIE, J. A., JACOBUS, D. D., GAINES, JR., J. M., BENEDICT, M., AND BLAISDELL, B. E. **VII. The theory of the correction of the observations on gas thermometers for the imperfections of the apparatus and of the thermometric fluid.** BEATTIE, J. A., BENEDICT, M., AND KAYE, J. *Proc. Amer. Acad. Arts Sci.*, 74, 11, *pp.* 327–370, 1941.—[See Abstr. 1726 (1937)]. Methods of constructing, calibrating and testing a duplicate const. vol. gas thermometer and auxiliary equipment for the realization of the abs. scale from 0° to 450°C. are given, together with the procedure adopted for the comparison of the International Temperature Scale with the abs. scale. —The differences between the ideal and experimental c.v. and c.p. gas thermometers are discussed and a detailed analysis made of the corrections necessitated by the imperfections of the manometer and thermometer systems and of the thermometric fluid, when Kelvin temperatures are computed from observations made with these thermometers. The treatment includes the use of the auxiliary gas thermometers for the determination of the dead-space correction in the region of large thermal gradients. R. W. P.

1562 536.511 : 532.631

An experimental study of the absolute temperature scale. IX. The determination of the capillary depression and meniscus volume of mercury in a manometer. BEATTIE, J. A., BLAISDELL, B. E., AND KAYE, J. *Proc. Amer. Acad. Arts Sci.*, 74, 11, *pp.* 389–397, 1941.—Methods of determining these corrections are discussed; an X-ray shadowgraph method for the capillary const. of Hg is the most accurate. R. W. P.

1563 536.511 : 536.413

An experimental study of the absolute temperature scale. VIII. The thermal expansion and compressibility of vitreous silica and the thermal dilatation of mercury. BEATTIE, J. A., BLAISDELL, B. E., KAYE, J., GERRY, H. T., AND JOHNSON, C. A. *Proc. Amer. Acad. Arts Sci.*, 74, 11, *pp.* 371–388, 1941.—Values of the following are tabulated for Hg from 0° to 350°C.; the true and mean coeff. of thermal dilatation, the density and sp. v., and the ratio of the densities at $t°$ and at 0°C. For vitreous silica the true and mean coeff. of linear thermal expansion and of thermal dilatation at temperatures from 150° to 450°C. are tabulated. R. W. P.

1564 536.62

Note on temperature correction methods in calorimetry. JESSUP, R. S. *J. Appl. Phys.*, 13, *pp.* 128–137, *Feb.*, 1942.—It is shown that the large errors referred to by King and Grover [Abstr. 1856 (1941)], in the usual methods of correcting bomb-calorimeter data are almost completely eliminated by the normal experimental calibration of the calorimeter. In the method of mixtures the errors are also avoided when the experiment is so conducted that the final temperature of the calorimeter is near the convergence temperature. R. W. P.

See Abstr. 1685 536.63 : 539 : 548.73

See Abstr. 1675–1681 536.631 : 548

1565 536.657

Heats of dissociation of some hexa-arylethanes. PRECKEL, R., AND SELWOOD, P. W. *J. Amer. Chem. Soc.*, 63, *pp.* 3397–3403, *Dec.*, 1941.—Magnetic measurements at several temperatures and conc. have been made on toluene solutions of hexa-arylethanes. The results show that the entropy change of dissociation is not independent of substituent, and they support the steric rather than the resonance theory of free radical stability. The ebullioscopic measurements may be useless for free-radical studies, and the colour of the solution is in no sense an accurate measure of free-radical conc.

See Abstr. 1507 536.7 : 532.77

1566 536.75

Effect of pressure on enthalpy of pentane, heptane, and iso-octane. GILLILAND, E. R., AND PAREKH, M. D. *Industr. Engng Chem.*, 34, *pp.* 360–362, *March*, 1942.—Data have been obtained on the isothermal enthalpy changes with pressure for *n*-heptane, *n*-pentane and iso-octane, by an experimental technique. The pressure and temperature ranges covered are 200 to 2 900 lb./in.^{2} and 330° to 660°K., respectively.

See Abstr. 1631 536.75 : 548.5 : 539.371

See Abstr. 1682 537 : 548

1567 537.226 : 621.3.015.51

Electric strength of dielectrics. AUSTEN, A. E. W., AND WHITEHEAD, S. HIPPEL, A. VON, MAURER, R. J., AND LEE, G. M. *Phys. Rev.*, 61, *pp.* 199–200, *Feb.* 1 *and* 15, 1942.—Correspondence. [See Abstr. 997 B (1941)].

1568 537.226.2 : 539.133 : 541.8

A contribution to the physical chemistry of the asphalts. SWANSON, J. M. *J. Phys. Chem.*, 46, *pp.* 141–150, *Jan.*, 1942.—Representative road oils were separated into 3 fractions: asphaltenes, resins, and oily constituents. Experiments on the dispersion of the dielectric const. with relatively dilute solutions of these fractions demonstrate that the asphaltenes and resins are polar and the oily constituents nonpolar in character. The dielectric-const. data were used to establish the macromolecular character of the asphaltenes and to develop a qualitative explanation of their solubility in various solvents. Special experiments were performed to show that the asphaltenes may be dispersed in an oil to form a sol which is stabilized by the presence of resins.

See Abstr. 1635 537.312 : 539.4.016.3

1569 537.312.6

Resistivity of antimony-tin single crystals at low temperatures. LANE, C. T., AND DODD, W. A. *Phys. Rev.*, 61, *pp.* 183–186, *Feb.* 1 *and* 15, 1942.—The resistivity was determined from 300°K. to 4·2°K. In all cases the crystals were orientated such that [111] was perpendicular to the electric field, and various amounts of Sn up to about 3 atom.% were employed. All the alloys showed normal metallic properties. The average temperature coeff. between 4·2°K. and 77·3°K. decreases sharply with increasing Sn content and assumes a small const. value at 3 atom.% Sn. While the addition of Sn at room temperature changes the resistivity only slightly, the effect at liquid-helium temperature is large. This residual resistivity is approx. a parabolic function of the Sn conc. Qualitative comparison of these results with the Bloch theory of metals is made.

See Abstr. 1557 537.323 : 538.66 : 536.212

1570 537.363 : 541.18.043 : 616.2

Electrophoretic and ultracentrifugal analysis of hay-fever-producing component of ragweed pollen extract. ABRAMSON, H. A., MOORE, D. H., AND GETTNER, H. H. *J. Phys. Chem.*, 46, *pp.* 192–203, *Jan.*, 1942.

1571 537.523.3 : 621.3.015.532

Threshold field studies of various positive corona phenomena. FITZSIMMONS, K. E. *Phys. Rev.*, 61, *pp.* 175–182, *Feb.* 1 *and* 15, 1942.—[Abstr. 727 B (1942)].

1572 537.523.5 = 3

Experiments with an interruptive arc operated by pulsating d.c. MEYER-EPPLE, W., AND KOEHLER, W. *Arch. Elektrotechn.*, 35, *pp.* 603–608, *Nov.* 17, 1941.—The arc is used for spectral analysis of light metals. Its ignition is initiated by h.f. impulses, but the duration of the arc is controlled by feeding with a pulsating d.c. obtained by a series connection of a d.c. and an a.c. supply. The min. value of the resultant voltage is kept smaller than the extinction voltage. Using Al electrodes and an a.c. of 50 c./s., discharges of 0·004–0·015 sec. duration are obtainable for about 45 min. A brief theory is given and the experimental results are in agreement. R. N.

1573 537.523.5 : 621.316.932

Arc cathodes of low current density at high amperage. SLEPIAN, J., BERKEY, W. E., AND KOFOID, M. J. *J. Appl. Phys.*, 13, *pp.* 113–116, *Feb.*, 1942.—[Abstr. 765 B (1942)].

1574 537.531 : 535.2 = 3

On the azimuthal intensity distribution of X-rays in the voltage range 45–150 kV. SESEMANN, G. *Ann. Phys., Lpz.*, 40, 1, *pp.* 66–84, 1941.—The azimuthal intensity distribution of X-rays [Abstr. 2933 (1939)] at 45, 60, 75, 90, 120 and 150 kV, is investigated with Be as anticathode, using Al and Cu filters and 4 systematically increasing filter thicknesses at each voltage. The results on the shape of the measured intensity curves can be explained qualitatively from the theoretical distribution curves. The position of the intensity max. for the radiation most strongly filtered agrees with the Sommerfeld theory for the boundary wavelength. The theoretically expected migration of the intensity max. with greater wavelength to smaller angles at const. voltage can be regarded as confirmed experimentally. H. G. S.

1575 537.531 : 535.3 : 548

The temperature diffuse scattering of X-rays by potassium chloride and potassium bromide crystals. HALL, J. H. *Phys. Rev.*, 61, *pp.* 158–167, *Feb.* 1 *and* 15, 1942.—The diffuse scattering was investigated with Cu $K\alpha$ radiation. The displacements of the temperature diffuse max. from the Bragg scattering angle were obtained experimentally for various settings of the crystal near the 400, 420 and 440 Bragg reflections. The theoretical displacement curve for the special case of KCl was calculated by considering the relative effects of the α_1 and α_2 wavelengths at the different angles of incidence. The experimental results agree with theory. The $\frac{1}{2}$-widths and rel. intensities were noted experimentally and corrections applied for the vertical divergence of the slit system.

1576 537.531 : 535.3 : 548

The relationship between the size and shape of crystal particles and the width of Debye–Scherrer lines. WALLER, I. *Nova Acta Soc. Sci. Upsal.*, 11, 7, *pp.* 3–10, 1939.—A general expression is derived for the breadth of a line in an X-ray powder photograph, the breadth being defined as the ratio of the total intensity of the line to the max. J. T.

1577 537.531 : 535.3 : 548 = 4

Diffuse reflection of X-rays by thermal waves in crystals (diamond). WEIGLE, J. *Helv. Phys. Acta*, 14, 7, *pp.* 595–605, 1941.—A further theoretical study [see Abstr. 1323 (1942)], which is a simplification of the treatment by Waller and by Zachariasen. Only thermal waves of long wavelength need be considered in connection with the diffuse reflection of X-rays, the existence of which may be attributed to the presence of clouds of points of greater or lesser density around the usual points of the reciprocal lattice. The results obtained are applied to the case of diamond, for which surfaces of equal density are constructed. J. T.

1578 537.531 : 535.3 : 548 = 3

Reflex curves of X-rays with crystals. MAIER, W. *Ann. Phys., Lpz.*, 40, 2, *pp.* 85–120, 1941.—[See Abstr. 1555 (1931)]. A comprehensive discussion of catoptrics of reflex curves (spirals); types of spirals and their dependence on type and position of the structure planes; geometric position of the pts. of intersection of the extended reflex rays; reflex rays from rocksalt; X-ray refraction; node formation of the reflex curves with rocksalt. H. G. S.

1579 537.531 : 535.3 : 548.73

Quantum theory and diffuse X-ray reflections. BORN, M., LONSDALE, K., AND SMITH, H. *Nature, Lond.*, 149, *pp.* 402–405, *April* 11, 1942.—Correspondence. [Abstr. 793 (1942)].

1580 537.531 : 615.849

The spatial distribution of X-rays and total energy absorption. A consideration of the importance of these concepts in the X-ray treatment of cancer. SMITHERS, D. W. *Brit. J. Radiol.*, 15, *pp.* 50–55, *Feb.*, 1942.—Dosage factors have been recognized with respect to dosage at the skin, dose given to the tumour, quality of radiation, dosage rate on the skin and time-spacing of the treatment. Recently these

concepts have been modified with respect to the distribution of radiation throughout the whole volume of tissue irradiated, the integral dose being the total volume absorption, which varies with different techniques, although the same dose may be given to the skin. Such 3-dimensional distribution is discussed. B. J. L.

See Abstr. 1586 537.531.85 : 535.4 : 537.533.73

1581 537.531.9 + 539.185.9] : 58

Relative effects of X-rays and neutrons on chromosomes in different parts of the "resting stage." MARSHAK, A. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 29–35, *Feb.*, 1942.

1582 537.533.72

Trajectories of mono-energetic electrons, in an arbitrary static electromagnetic field, in the neighbourhood of a given trajectory. MACCOLL, L. A. *J. Math. Phys.*, 20, *pp.* 355–369, *Dec.*, 1941.—The theory is generalized, considering electrons moving with fixed total energy in an arbitrary static electromagnetic field and trajectories in the neighbourhood of an arbitrary trajectory. Various types of images, the conditions for their formation, types of distortion, etc., are investigated.

1583 537.533.72 : 58 = 3

Electron supermicroscopy of living substances. ARDENNE, M. V. **Germination of the spores of the Bacillus Vulgatus from photographs in the 200 kV universal electron microscope.** ARDENNE, M. V., AND FRIEDRICH-FEKSA, H. *Naturwissenschaften*, 29, *pp.* 521–528, *Aug.* 29, 1941.—[See Abstr. 4399 (1939)]. The technique of the method is described and the principles of the shading device briefly explained. Photographs of the spores of the potato bacillus without impairing their germinability are taken in the universal electron microscope [Abstr. 2257 (1940)], are reproduced and explained. The dosage necessary to kill a spore with the radiation voltage used (180 kV) is of the order of 10^5 electrons per spore. H. G. S.

1584 537.533.73

Extra spots in electron diffraction patterns. CHARLESBY, A., AND WILMAN, H. *Nature, Lond.*, 149, *pp.* 411–412, *April* 11, 1942.

1585 537.533.73 = 3

Electron interferences in the convergent beam. KOSSEL, W., AND MÖLLENSTEDT, G. *Ann. Phys., Lpz.*, 36, 2, *pp.* 113–140, 1939.—The dependence on direction of the elementary processes of diffraction are investigated by applying an electron-optically produced beam of finite opening to a very thin single crystal. In addition to the immediate reflexes, multiple reflexes and their interactions, new systems of parallel interference bands are obtained from the limitation of the crystal size. Their utility for making observations on the distribution of electron waves in crystals is demonstrated. The technique and apparatus are fully described with diagrams and photographic reproductions of the results. [See also Abstr. 5013 (1937)]. H. G. S.

1586 537.533.73 : 537.531.85 : 535.4 = 3

On the structure of the interference patterns in the convergent electron beam. KOSSEL, W. **Measurements on the interference phenomena in the convergent electron beam.** MÖLLENSTEDT, G. *Ann. Phys., Lpz.*, 40, 1, *pp.* 17–65, 1941.—These 2 papers form a continuation of previous investigations [Abstr. 1585 (1942)]. A systematic comparison is made with the usual method of the finely screened parallel ray, and the close relations between the electron-beam method and the Compton–Doan X-ray method and the rings of equal inclination of optics are pointed out. The 3 methods can be combined in one fundamental notion realized in 3 different orders of magnitude of the wavelengths and lattice const. Interference patterns and lattice const. of mica are given, and the dependence on the crystal thickness of the band widths are determined, as well as the dependence on voltage of the dispersion. H. G. S.

1587 537.533.74

Electron polarization. SHULL, C. G. *Phys. Rev.*, 61, *p.* 198, *Feb.* 1 *and* 15, 1942.

1588 537.533.75 : 539.166.75

The absorption of the primary β-radiation from radium in lead and platinum and the specific γ-ray dose rate at a filtration of 0·5 mm. of platinum. NEARY, G. J. *Brit. J. Radiol.*, 15, *pp.* 104–109, *April*, 1942.—The experimental details are described, with those of the graphite thimble ionization chamber used, and particulars of the radium source is given. The range of the primary β-radiation in Pt was 0·53 mm., the ratio of β- to γ-radiation ionization at 0·50 mm. of Pt was of the order of 1% and the mass absorption coeff. of the hard component of the β-radiation is 7·7 cm.^{2} g. B. J. L.

1589 537.533.79 : 535.234

The theory of particles of spin half and the Compton effect. BHABHA, H. J., AND BASU, D. *Proc. Indian Acad. Sci. A*, 15, *pp.* 105–117, *Feb.*, 1942.—The original Dirac theory, in which a particle of spin $\frac{1}{2}\hbar$ is described with all negative energy states empty, and the hole theory, in which all the negative energy states are filled each with 1 electron, do not in general lead to the same probabilities for second-order processes. The formula for the scattering of radiation by a free electron on the hole theory is calculated. The new formula agrees with the Klein–Nishina formula only when the energy of the light quantum is small compared with the rest mass of the electron. Thus the hole theory is in definite disagreement with experiments on scattering.

1590 537.533.8 = 3

New measurements of the absorption, back-diffusion and secondary-ray excitation of medium-speed cathode rays in aluminium and gold. WECKER, F. *Ann. Phys., Lpz.*, 40, 6, *pp.* 405–424, 1941.—Parallel c.r. beams of 20–80 kV vel. falling on Al and Au are used, and the measurements are made with 2 electrometers. The technique and apparatus are described and the results discussed and given in tables and diagrams. After separating the secondary radiation by evaluation from the counter-voltage curves, penetration depths, dependent on ray vel. and material, are obtained by interpolating to zero the transmitted intensity. The connection with the Lenard boundary thicknesses is indicated. For Al the back-diffusion drops with increasing speed; in Au it is almost const. The change in radiative power of the emerging secondary radiation with the primary vel. agrees with the known results; on the incident side there is less radiative

power, pointing to lower secondary-ray excitation by penetrating primary rays, and this secondary-ray excitation is less for Au than for Al. H. G. S.

1591 537.534.8 = 3

On the light excitation by collision of He^+ ions with Ne atoms. TRITTELVITZ, W. *Ann. Phys., Lpz.*, 40, 2, *pp.* 131–153, 1941.—A difference method is used in which not only the light produced by the natural mixture of the ions and neutral particles, but also that entirely due to the residual particles, after the electrostatic removal of all the ions, is investigated. A full description is given of the experimental method and apparatus used, and the results are analysed and compared with those of earlier investigators. It is concluded that the quantum energy of 3 V, released in the reversal of charge which occurs between He^+ and Ne, passes over not into radiation but into kinetic energy. [See Abstr. 2115 (1939)]. H. G. S.

1592 537.59 : 550.87

A scientific investigation of the claims of the water-diviner or "dowser." *Elect. Times*, 101, *pp.* 628–630, *Feb.* 19, 1942.—Experiments with sensitive ionization indicators showed the presence of ionization in the "dowsing" field. The dowser could detect variations in the field strength of a short-wave radio transmitter. The physical source of energy of dowsing fields and reactions seems to be some form of cosmic radiation. A. P. W.

1593 537.591 : 539.172.1

Frequency of proton and alpha tracks in cosmic-ray "stars." SHAPIRO, M. M. *Phys. Rev.*, 61, *pp.* 115–120, *Feb.* 1 *and* 15, 1942.—Special photographic plates were left on Mt. Evans for 8 months. From a statistical investigation of 365 tracks in 142 cosmic-ray "stars" found in one of these emulsions, it is estimated that more than 90% of the tracks were produced by protons. Most of the remaining star tracks are probably due to α-particles of energy < 9 eMV.

1594 537.591.1

Origin of the soft component of cosmic rays. ROSSI, B., AND GREISEN, K. *Phys. Rev.*, 61, *pp.* 121–128, *Feb.* 1 *and* 15, 1942.—The number of electrons arising from the decay of mesotrons has been calculated with the multiplication theory. A comparison with experimental data indicates the existence of an electron component having a sharper max. in the vertical direction and increasing with altitude more rapidly than the decay electrons.

1595 537.591.15

The second maximum in the Rossi curve. MOHR, C. B. O., AND STAFFORD, G. H. *Nature, Lond.*, 149, *pp.* 385–386, *April* 4, 1942.

1596 537.591.3

Transition curves for electron- and photon-produced showers. NERESON, N. *Phys. Rev.*, 61, *pp.* 111–115, *Feb.* 1 *and* 15, 1942.—An investigation of the air-to-lead transition. The max. of the curve for photon-produced showers is displaced to the right with respect to the max. for electron-produced showers by a thickness of 3 mm. of Pb. This agrees with shower theory. The max. for large showers lies at a greater thickness than that for small showers. The occurrence of a second max. in the transition curve was checked and a negative result obtained.

1597 537.591.5

The time distribution of cosmic rays. SARABHAI, V. *Proc. Indian Acad. Sci. A*, 15, *pp.* 89–104, *Feb.*, 1942.—The distribution of cosmic rays was compared with that due to radioactivity, using counters. At least up to $\frac{1}{5}\frac{1}{0}$ sec., the arrivals of cosmic rays follow a law to be expected from complete time randomness; their behaviour is therefore similar to that of radiations from radioactive sources.

1598 538.224

The diamagnetism of the halogens. RAO, S. R., AND GOVINDARAJAN, S. R. *Proc. Indian Acad. Sci. A*, 15, *pp.* 35–51, *Jan.*, 1942.—Magnetic properties of Cl, Br and I, dissolved in organic solvents have been studied. In all cases except cyclohexane the susceptibility of dilute solutions is greater than for the free halogen. The ionization of the halogen element and the formation of loose molecular compounds between solvents and solutes are examined. Magnetic properties are correlated with optical properties of I solutions.

See Abstr. 1500 538.247

See Abstr. 1476 538.3 : 530.12

See Abstr. 1603 538.3 : 539.132

1599 538.312

On the motion of an electric particle. OPATOWSKI, I. *J. Math. Phys.*, 20, *pp.* 418–424, *Dec.*, 1941.—The particle is assumed to move in electric and magnetic fields of a general form, which include the most important (fields symmetric about an axis, plane fields, etc.); forbidden regions are determined and cases are indicated where the equation of motion can be simplified or explicitly integrated.

1600 538.565 : 535.215.1 = 3

Photo-electrically sensitive semi-conductors and resistances in the oscillatory circuit. GOOS, F. *Ann. Phys., Lpz.*, 40, 6, *pp.* 425–447, 1941.—Previous results [Abstr. 3830 (1939)] are generalized and dealt with quantitatively and graphically with the aid of an equivalent circuit. Effects of variations in the equivalent circuit and frequency on the frequency change produced in the oscillatory circuit are explained with vector diagrams. The frequency changes are measured by capacitance compensation. Generally valid formulae summarize the results. The min. conduction and capacitance found by varying the parallel capacitance in the equivalent circuit are also generalized [see Abstr. 2430 (1941)]. The magnitude of the parallel capacitance of a Se cell is determined, from which deductions relating to the dielectric const. of a semi-conductor and its alteration on exposure to light can be deduced. Several possible methods of connecting a semi-conductor in the h.f. circuit giving exceptional sensitivity to light, e.g. of a Se cell, are included. H. G. S.

See Abstr. 1531 538.615 : 535.338

See Abstr. 1557 538.66 : 537.323 : 536.212

See Abstr. 1685 539 : 536.63 : 548.73

1601 539.13

The denaturation of proteins and its apparent reversal. III. NEURATH, H., COOPER, G. R., AND ERICKSON, J. O. *J. Phys. Chem.*, 46, *pp.* 203–211, *Jan.*, 1942.

1602 539.132 = 3

Static meson field. WENTZEL, G. *Helv. Phys. Acta*, 14, 7, *pp.* 633–635, 1941.—Correction. [Abstr. 37 (1941)].

See Abstr. 1441 539.132 : 517.942.6 : 517.432

See Abstr. 1453 539.132 : 521.13

1603 539.132 : 538.3 = 4

Some remarks on the application of the theory of non-resistive circuits to molecular collisions. GUYE, C. E. *Helv. Phys. Acta*, 14, 7, *pp.* 583–587, 1941.—The idea that the theory of non-resistive circuits could be applied with advantage to orbital circuits is developed. The process introduces simplification into the investigation of the theory of intramolecular phenomena, especially molecular collisions. A. J. M.

See Abstr. 1508 539.133 : 532.77

See Abstr. 1568 539.133 : 541.8 : 537.226.2

1604 539.15 : 530.145

Precise determination of the fine-structure constant from X-ray spin doublet splitting. CHRISTY, R. F., AND KELLER, J. M. *Phys. Rev.*, 61, *pp.* 147–152, *Feb.* 1 *and* 15, 1942.—Corrections to the Sommerfeld formula for the L_{II}–L_{III} X-ray spin doublet splitting, to take into account departures from a pure Coulomb field for heavy elements caused by interactions between electrons, are calculated by using Dirac wave functions for a Coulomb field and calculating, with all relativistic corrections, the terms in the electron interaction of order e^2. The result is applied to experimental data for elements varying from $Z = 60$ to $Z = 92$.

1605 539.152.1

On tensor forces and the theory of light nuclei. GERJUOY, E., AND SCHWINGER, J. *Phys. Rev.*, 61, *pp.* 138–146, *Feb.* 1 *and* 15, 1942.—The existence of non-central tensor forces in nuclei is indicated by the quadrupole moment of the deuteron. The effect of 2-body tensor forces on the ground-state eigenfunctions of the nuclei H^3 and He^4 has been calculated. In H^3 the tensor forces directly couple to the fundamental $^2S_{\frac{1}{2}}$ state a $^4D_{\frac{1}{2}}$ state, which in turn interacts with $^2P_{\frac{1}{2}}$ and $^4P_{\frac{1}{2}}$. In the case of He^4 there is admixture of the fundamental $^1S_0$ with a $^5D_0$ state, which is coupled by tensor forces to $^3P_0$. These nuclei constitute the simplest examples of the complete breakdown of spin and orbital angular momentum conservation laws. In order to describe forces between all pairs of nuclear particles on the basis of the theory of Rarita and Schwinger, the binding energies of H^3 and He^4 have been estimated by a variation method. The probability that these nuclei are in a D state is 4% in each case. The tensor forces which account for all the binding in the deuteron are comparatively ineffective in binding H^3 and He^4. A. J. M.

1606 539.155.2 = 3

On separation experiments of the xenon isotopes by rectification; the triple point of xenon. CLUSIUS, K., STAVELEY, L., AND DICKEL, G. *Z. phys. Chem. B*, 50, *pp.* 403–413, *Nov.*, 1941.—Although the difference in v.p. at the triple point of Xe isotopes is only about 1 mm., an attempt was made to separate the isotopes by rectification. The densities were measured by a gas balance; the necessary corrections are discussed. Parallel tests were made with the separator tube [Abstr. 2456 (1941)]. Separation was not obtainable by rectification, as all pure Xe samples showed the same average atom. wt. and the same triple-point pressure. R. N.

See Abstr. 1692 539.16 : 550.42

1607 539.16.08

The behaviour of proportional counter amplification at low voltages. ROSE, M. E., AND RAMSEY, W. E. *Phys. Rev.*, 61, *pp.* 198–199, *Feb.* 1 *and* 15, 1942.—[See Abstr. 1919 (1941)].

1608 539.16.08

A precision method of measuring Geiger counter resolving times. BEERS, Y. *Rev. Sci. Instrum.*, 13, *pp.* 72–76, *Feb.*, 1942.—The counting rates due to 2 separate const. β-ray sources and due to the 2 sources combined are measured. The sum of the counting rates due to the single source exceeds that due to the combined source. Formulae are derived by which the resolving time and errors involved can be calculated from these quantities. High accuracy can be obtained without excessive expenditure of time and without use of large counting rates.

1609 539.16.08

A modification of the Barnes Geiger–Müller counter. WANG, J. C., MARVIN, J. F., AND STENSTROM, K. W. *Rev. Sci. Instrum.*, 13, *p.* 81, *Feb.*, 1942.

1610 539.162 = 3

New strontium and ytterbium isotopes from uranium fission. GÖTTE, H. *Naturwissenschaften*, 29, *pp.* 496–500, *Aug.* 8, 1941.—The isotopes discussed are a complex 6 hr. Sr comprised of a 2·7 hr. and an 8·5 hr. Sr isotope, a 57 day Yt, a 50 min. Yt, two 8·5 hr. Sr isotopes, and a 26-day Zr. H. G. S.

See Abstr. 1588 539.166.75 : 537.533.75

1611 539.166.832 = 3

Effective cross-section for the materialization of the 2·62 eMV γ-rays in argon. ZUBER, K. *Helv. Phys. Acta*, 15, 1, *pp.* 38–44, 1942.—The Compton process and pair-formation in A have been investigated by means of an automatic Wilson chamber. The effective cross-section for the materialization of 2·62 eMV γ-rays for the A atom is $\sigma\rho = (1{\cdot}31 \pm 0{\cdot}12) \times 10^{-25}$ cm.^{2} Materialization in the Coulomb field of atomic electrons could not be observed. A. J. M.

1612 539.167.3 = 3

The artificial production of naturally radioactive elements. FLÜGGE, S. *Naturwissenschaften*, 29, *pp.* 462–467, *Aug.* 1, 1941.—A report of recent work conducted with the cyclotron on the production of RaE and RaF (Po) from Bi, UY from Th, the Th isotope AcC″ from Pb and the Po isotope AcC′ from Bi. In a table are given the theoretical possibilities of producing the natural radioactive elements by neutrons, protons, deuterons, α-particles and γ-rays. H. G. S.

See Abstr. 1593 539.172.1 : 537.591

1613 539.172.4 = 3

Nuclear reactions of fluorine with fast neutrons. SCHERRER, P., HUBER, P., AND ROSSEL, J. *Helv. Phys. Acta*, 14, 7, *pp.* 618–624, 1941.—When ^{19}F is irradiated with rapid neutrons ($\sim$ 3 eMV) the following reactions occur: $^{19}_{9}F + {}^{1}_{0}n = {}^{16}_{7}N + {}^{4}_{2}He + Q_1$; $^{19}_{9}F + {}^{1}_{0}n = {}^{19}_{8}O + {}^{1}_{1}H + Q_2$. Since the mass of ^{19}F is known to be 19·004 54 ± 0·000 24, determination of the energy

tonality, Q_1 and Q_2, makes it possible to obtain the masses of $^{16}_{7}N$ and $^{19}_{8}O$. The reactions have been studied by means of an ionization chamber and a linear amplifier. The values obtained for the masses are $^{16}N = 16{\cdot}008\,87 \pm 0{\cdot}000\,61$, $^{19}O = 19{\cdot}004\,84 \pm 0{\cdot}000\,55$. A. J. M.

1614 539.185

Elastic and inelastic scattering of fast neutrons. BARSCHALL, H. H., AND LADENBURG, R. *Phys. Rev.*, 61, *pp.* 129–137, *Feb.* 1 *and* 15, 1942.—The scattering of the 2·5 eMV *d–d* neutrons by C, Al, Fe, Cu, Zn and Pb, was investigated by analysing the distribution in energy of recoiling α-particles in an ionization chamber. Measurements were carried out for scattering angles of the neutrons of 45° and 100°. The differential cross-section for elastic scattering was measured, and the amount of inelastic scattering could be estimated. The elastic scattering showed a strong anisotropy whereas the inelastic was the same for the 2 angles. The ratio of elastic to inelastic scattering was larger in C, Al and Pb, than in Fe and Cu.

1615 539.185

The mean life of neutrons in water and the hydrogen capture cross-section. MANLEY, J. H., HAWORTH, L. J., AND LUEBKE, E. A. *Phys. Rev.*, 61, *pp.* 152–155, *Feb.* 1 *and* 15, 1942.—Direct observations of the time variation of slow-neutron density in a large volume of water during and after irradiation by neutrons from the D–D reaction have been made. An exceptional growth and decay is found. From these data, and data on the spatial density distribution which determines the effect of diffusion, the mean life of neutrons in water was found to be 205 ± 10 μsec. This leads to a cross-section of $0{\cdot}33 \times 10^{-24}$ cm.^{2} for the capture of slow neutrons by H.

See Abstr. 1581 539.185.9 + 537.531.9] : 58

1616 539.21

On the nature of a polished surface. MOTZ, L. *J. Opt. Soc. Amer.*, 32, *pp.* 147–148, *March*, 1942.—[See Abstr. 614 (1941)].

See Abstr. 1684 539.214 : 536.4 : 548.73

1617 539.215

Open packing of spheres. MELMORE, S. *Nature, Lond.*, 149, *p.* 412, *April* 11, 1942.

1618 539.215.4

Relation of paint properties to surface areas of carbon black. BROWN, JR., O. J., AND SMITH, W. R. *Industr. Engng Chem.*, 34, *pp.* 352–355, *March*, 1942.—The total surface areas of a number of carbon blacks have been determined from low-temperature nitrogen adsorption isotherms. The commercially significant properties appear to be direct functions of this surface.

1619 539.215.4 : 669.7

The grain-size of rolled aluminium. PHILLIPS, H. W. L. *J. Inst. Met.*, 68, *pp.* 47–106, *March*, 1942.—A rapid rate of heating through the recrystallization range, a high temperature during hot rolling, heavy pinches during cold rolling, and a high content of iron, are all factors which favour the development of a fine grain on annealing. Prolonged annealing, a high temperature of annealing, and high contents of silicon favour grain coarsening. Rolling to thin gauges without intermediate annealing frequently results in a coarse-grained structure: the imposition of an intermediate anneal at a point sufficiently remote from the finishing thickness is beneficial. The initial stages of recrystallization have been studied, and theories are advanced to account for the existence of the max. in the grain-size cold-work curve, and for the variation between samples rolled under controlled and apparently identical conditions from duplicate rolling blocks taken from the same cast.

1620 539.216

Dispersion of cellulose strands in cell walls. FREY-WYSSLING, A. *Nature, Lond.*, 149, *p.* 384, *April* 4, 1942.

1621 539.216.1 = 3

The supermolecular structure of hydrated cellulose. BAUKE, B., KRATKY, O., AND TREER, R. *Z. phys. Chem. B*, 50, *pp.* 255–297, *Nov.*, 1941.—The structure is characterized by a network of crystalline micelles interconnected by threadlike fringes, the latter forming an amorphous range. A theory of the orientation of the micelles during deformation is based on the assumption, justified by X-ray results, of a leaf-like shape, and an affine deformation of the surroundings of the micelles. The elongation and the shrinking, where highly swollen threads are stretched, is explained. R. N.

See Abstr. 1488 539.217 : 536.24 : 531.72

See Abstr. 1510 539.219 : 533.723

1622 539.26

The structure of polychloroprene. CLEWS, C. J. B. *Proc. Roy. Soc. A*, 180, *pp.* 100–107, *March* 18, 1942.—Specimens of polychloroprene before and after light treatment have been examined by X-ray methods. There is no change in the crystalline structure, although there are differences in the physical properties ascribed to cross-linking of the long-chain molecules. The unit cell is possibly orthorhombic and contains 4 chloroprene (C_4H_5Cl) units.

1623 539.26

A new structure of carbon. LIPSON, H., AND STOKES, A. R. *Nature, Lond.*, 149, *p.* 328, *March* 21, 1942.

1624 539.26

The X-ray microscope. BRAGG, W. L. *Nature, Lond.*, 149, *pp.* 470–471, *April* 25, 1942.

1625 539.26

A study of allotropes of selenium by the X-ray diffraction method. GUPTA, K. DAS, DAS, S. R., AND RAY, B. B. *Indian J. Phys.*, 15, *pp.* 389–399, *Oct.*, 1941.

1626 539.26 = 3

Recent results of starch research. SAMEC, M., AND BLINC, M. *Kolloid-Beih.*, 52, *pp.* 57–86, *Oct.* 29, 1940.—The forms of X-ray diagrams of various starches are discussed, especially those obtained with drying, pasting and ageing. R. N.

1627 539.26 = 3

On the swelling and the mechanism of dissolution of xanthogenated sodium cellulose fibres. SCHRAMEK, W., METZNER, U., AND SEIDEL, E. *Z. phys. Chem. B*, 50, *pp.* 298–304, *Nov.*, 1941.—The question is discussed whether the disappearance of X-ray interference rings

with xanthogenated cellulose indicates a molecular disperse state of distribution. That this is not the case is proved by analogous tests made with the swelling of regenerated cellulose fibres treated with 9–9·5% NaOH. The probable causes for the phenomenon are discussed. R. N.

1628 539.26 : 541.182.5

X-ray diffraction studies on heavy-metal iron-cyanides. WEISER, H. B., MILLIGAN, W. O., AND BATES, J. B. *J. Phys. Chem.*, 46, *pp.* 99–111, *Jan.*, 1942.—The X-ray diffraction patterns of $Ti_3[Fe(CN)_6]_4$, $Ti[Fe(CN)_6]$, $In[Fe(CN)_6]$, Prussian Blue, Turnbull's Blue, $Al_4[Fe(CN)_6]_3$, $Sc_4[Fe(CN)_6]_3$, $In_4[Fe(CN)_6]_3$, $Mn_3[Fe(CN)_6]_2$, $Cd_3[Fe(CN)_6]_2$, $Cu_3[Fe(CN)_6]_2$, $Cu_3[Fe(CN)_6]_2$ and $Cu_2[Fe(CN)_6]$ are found to be so similar with respect to the position and relative intensities of the diffraction lines, that these compounds are held to form an isomorphous series with face-centred cubic symmetry. The diffraction patterns of $La_4[Fe(CN)_6]_3$, $La[Fe(CN)_6]$, and $Nd_4[Fe(CN)_6]_3$ differ from the patterns of the other iron-cyanides studied. The results of X-ray diffraction investigations, density determinations and measurements of oxidation-reduction potential, indicate that Prussian Blue and Turnbull's Blue are identical chemical individuals. H. H. HO.

1629 539.26 : 669.1

On the carbide and nitride particles in titanium steels. HUME-ROTHERY, W., RAYNOR, G. V., AND LITTLE, A. T. *J. Iron Steel Inst.*, [11 *pp.*], 1942. *Advance copy.*—A microscopic examination has been made of the structures of titanium steels containing from 0·1 to 1·0% of C and from 0 to 6·0% of Ti. Special attention was paid to the impurity constituents, usually referred to as Ti_2N_2. These consist of a series of particles ranging from yellow → orange → brown to grey, the grey particles being almost indistinguishable from TiC. The general effect of increasing C content was to change the predominant colour from yellow to grey. Residues were extracted by electrolytic attack in HCl and submitted to chemical analysis and X-ray examination. The analyses suggest that in the orange and brown crystals some of the N_2 of Ti_2N_2 was replaced by C. The X-ray investigation showed that the yellow, orange and brown crystals, gave rise to diffuse diffraction lines corresponding to face-centred cubic structures with lattice spacings between those of TiC and TiN.

1630 539.262 : 548.73

A new method in X-ray crystallography. OROWAN, E. *Nature, Lond.*, 149, *pp.* 355–356, *March* 28, 1942. —Describes an X-ray "back reflection" camera which gives both the spacings and positions of the reflecting planes in a rotation or oscillation photograph. A grid of thin parallel wires is placed very close to the (flat) film and rotated in its own plane through not more than 180° during one exposure. It is geared to the crystal holder, so that the position of the crystal for any given reflection is obtainable from the inclination of the shadow lines which pass through the corresponding diffraction "spot." The method has possible applications to the analysis of the background and to the investigation of mosaic imperfections. J. T.

See Abstr. 1511 539.32 : 534.1

1631 539.371 : 536.75 : 548.5

A statistical treatment of crystallization phenomena in high polymers. ALFREY, T., AND MARK, H. *J. Phys. Chem.*, 46, *pp.* 112–118, *Jan.*, 1942.—An attempt is made to explain the anomalous crystallization behaviour of high polymers on the basis of entropy changes in the amorphous material. The free energy of the amorphous phase depends not only upon the temperature and pressure, but also upon the degree of extension and the fraction of crystalline material. A model embodying these characteristics is proposed. It is possible to explain the unsharp m.p. of rubber, the dependence of crystallization upon the degree of extension, and the phenomenon of spontaneous extension.

1632 539.384.4

Rational column analysis. BROEK, J. A. VAN DEN. *Engng J. Can.*, 24, *pp.* 570–583, *Dec.*, 1941.—An analysis of eccentrically loaded prismatic columns with or without initial crookedness, with discussion of formulae used in their solution. Eccentricity, e, may be replaced by the coeff. L/l (ratio of length of column to distance between points of inflection). Tests are recorded in which e is controlled up to the point of failure, and the load/axial deformation relationship is recorded far beyond the critical load. Everything points to the sufficiency of Euler's theory. G. E. A.

See Abstr. 1634 539.389 : 669.18 : 539.4.016

1633 539.4.012.1 : 621.821

Finite strain in a rotating shaft. SETH, B. R. *Proc. Indian Acad. Sci. A*, 14, *pp.* 648–651, *Dec.*, 1941.

See Abstr. 1638 539.4.013.3 : 539.43

1634 539.4.016 : 539.389 : 669.18

The work-hardening and ageing of steel. ANDREW, J. H., AND LEE, H. *J. Iron Steel Inst.*, [38 *pp.*], 1942. *Advance Copy.*—It is shown that carbon is dissolved during the work-hardening process, and that under certain conditions both austenite and martensite may form. A new theory of quench-ageing is suggested, and the subject of strain-ageing is dealt with. A new theory of the yield is developed, whilst the changes undergone during the extension of the tensile test-piece are shown to be dependent upon the total elongation and the condition of the carbide in the steel. [See Abstr. 3137 B (1938)].

See Abstr. 1637 539.4.016 : 539.412

1635 539.4.016.3 : 537.312

Precipitation hardening. FINK, W. L. *J. Appl. Phys.*, 13, *pp.* 75–83, *Feb.*, 1942.—When an Al-Cu alloy, such as duralumin, is heated to, say, 500°C., the Cu constituent becomes dissolved and atomically dispersed in the Al. The alloy is then quenched and the solid solution becomes unstable and tends to decompose into 2 phases—a more dilute solid solution and a crystalline form of $CuAl_2$. At first only nuclei of $CuAl_2$ are formed, but these grow during age-hardening at room temperature or at 100°C. when such an alloy is aged at room temperature, the stable nuclei are smaller than the particles which offer max. resistance to the flow of electric current, so that the resistivity first increases to a max. and then decreases again. When an Al-Cu alloy is aged, first at room temperature and then at 150–200°C.,

many of the smaller precipitate particles dissolve on heating to the higher temperature, since they are smaller than the particles which are stable at that temperature. This resolution of the small particles causes a softening of the material and a decrease of resistivity. Various theories of precipitation hardening are considered, and it is concluded that the process is one of crystal growth involving the normal "down-hill" type of diffusion. A. C. W.

1636 539.41

"Firmness" in compression and tension. BROOME, D. C., AND BILMES, L. *Nature, Lond.*, 149, *pp.* 412–413, *April* 11, 1942.

1637 539.412 : 539.4.016

Tensile elastic properties of nickel, copper, open-hearth iron and typical steels. MCADAM, JR., D. J., AND MEBS, R. W. *J. Res. Nat. Bur. Stand., Wash.*, 28, *pp.* 311–378, *March*, 1942.—From stress/set curves are derived proof stresses for 5 values of permanent set. From corrected stress/strain curves are derived values of the modulus at zero stress and its stress coeff. The diagrams show the influence of prior plastic extension on these indices. The curves of variation of the proof stresses with plastic extension are affected by the rate of work-hardening, by variation of internal stresses of 2 kinds, and by the rest interval. The curves of variation of the modulus of elasticity with plastic extension are affected by variation of crystal orientation, internal stress and lattice expansion, and by rest. The curves of variation of the stress coeff. of the modulus are affected by all these factors except possibly the re-orientation factor.

1638 539.43 : 539.4.013.3 = 3

Steady-load and fatigue strength and the effect of a single high overload. THUM, A., AND ERKER, A. *VDI [Z. Ver. dtsch. Ing.]*, 86, *pp.* 171–174, *March* 21, 1942.—Fatigue tests were made with 1 set of butt-welded (V groove) and 1 set of fillet welded specimens. The latter was more liable to notch effect. With small notch effect up to about 15 000 and with high notch effect up to about 5 000 cycles the swelling strain may be calculated in the same way as the static strain. Single overloads in the absence of notch effect are only dangerous if fissures are noticeable. R. N.

1639 539.434 : 669.1

The properties and mode of rupture of a molybdenum and a molybdenum-vanadium steel, judged from prolonged creep tests to fracture. TAPSELL, H. J., BRISTOW, C. A., AND JENKINS, C. H. M. *Rep. Brit. Elect. Allied Industr. Res. Assoc. Ref. J/T*128. *J. Proc. Instn Mech. Engrs*, 146, *pp.* 208–222, *March*, 1942.—The report deals with the nature of the failure at high temperatures of certain alloy steels, which are being used to replace carbon steels, and indicates the conditions of use under which the development of intercrystalline cracking can be avoided. Investigations are being continued with a view to finding steels of high creep strength, in which the onset of intercrystalline cracking can be displaced to higher temperatures.

1640 539.531

The hardness of metals as affected by alloying agents. SIEGEL, S. *J. Appl. Phys.*, 13, *pp.* 84–89, *Feb.*, 1942.—A simple test such as the determination of the critical shear stress should be used in connection with problems of the type of the hardening of solid solutions, rather than an indentation hardness test which is associated with considerable plastic flow and therefore with much work-hardening. The objection to indentation hardness tests lies in the fact that alloys have a much greater work-hardening capacity than pure metals, and even the latter differ among themselves. Various types of solid solution are considered, and it is concluded that (1) solutions are harder than pure metals, (2) in dilute solutions the hardness increases linearly with the number of solute atoms, (3) the hardening effect is greater, the more unlike the solute and solvent atoms are, and (4) a disordered solid solution is harder than the same alloy in a more ordered state, if no change in crystal structure occurs. These rules apply to α-solid solutions, while in intermediate solid solutions the crystal structure is generally more complex and the alloys are harder and brittle. A. C. W.

CHEMISTRY

See Abstr. 1473 54 : 53

1641 541.123.31

Vapour-liquid equilibria of the system acetone–acetic-acid–water. YORK, JR., R., AND HOLMES, R. C. *Industr. Engng Chem.*, 34, *pp.* 345–350, *March*, 1942.

1642 541.124

The kinetics of the reaction between manganous and permanganate ions. TOMPKINS, F. C. *Trans. Faraday Soc.*, 38, *pp.* 131–139, *April*, 1942.—This reaction is retarded by H ions, but is accelerated by increase in the conc. of either manganous or permanganate ions. The production of hydrous manganese dioxide is assisted by a heterogeneous reaction on the surface of this oxide, which catalyses the hydrolysis of the $Mn^{\cdots\cdot}$ ion. The surface reaction is affected by the presence of protective colloids.

1643 541.128 = 3

On the catalytic action of nickel and copper-thorium at the formation of methane and heavy gases. ITTERBEEK, A. VAN, AND DINGENEN, W. VAN. *Z. phys. Chem. B*, 50, *pp.* 341–360, *Nov.*, 1941.—Parallel measurements of adsorption at low pressures and of reaction velocity and gas-analytical measurements based on a physical principle proved the following law to apply to the formation of CH_4 and heavy gases in the presence of metallic catalysts: the speed of reaction attains a max. at such temperatures at which the reacting components are adsorbed on the metal surface in the ratio corresponding to the stoichiometric ratio of the chemical reaction. This law was examined and found to hold true also under varying pressures and in the presence of D_2. The properties of a catalyst may be conceived by adsorption measurements. For the pressure and the gas-analytic measurements sensitive heat-conductivity manometers were applied. R. N.

1644 541.133.1 : 541.135.5

The mobility of quinine ions, with some notes on the permeability of cellophane. PRIDEAUX, E. B. R. *Trans. Faraday Soc.*, 38, *pp.* 121–128, *April*, 1942.—The properties of cellophane as a medium for ionic diffusion have been investigated and compared with those of collodion, etc. It is shown that collodion

selectively hinders the anion, not only of the usual strong electrolytes, but also of salts of the alkaloids. Cellophane shows no selective ion permeability. The transport number of the anion is found to be 0·76, and the average mobility of the mixed quinine cations is 21·5.

1645 541.135.5

Studies in membrane permeability. III. The preferential ionic permeability of membranes of cupric ferrocyanide, and of parchment. WILLIS, G. M. *Trans. Faraday Soc.*, 38, *pp.* 169–179, *May*, 1942.—[See Abstr. 1370 (1940)]. Membrane potentials for $Cu_2Fe(CN)_6$ and parchment are recorded. The apparent mobilities of univalent anions are reduced as a result of their adsorption. Parchment membranes showed the usual conc. effect, and a definite influence of valency on the preferential ionic permeability.

See Abstr. 1644 541.135.5 : 541.133.1

1646 541.135.5 : 545.37 : 541.182.63

The electrochemical properties of mineral membranes. II. Measurement of potassium-ion activities in colloidal clays. MARSHALL, C. E., AND BERGMAN, W. E. *J. Phys. Chem.*, 46, *pp.* 52–61, *Jan.*, 1942.—[Abstr. 1907 (1941)].—Titration curves involving determinations of H-ion and K-ion activities were obtained for agar and for 4 clays: montmorillonite, beidellite, illite and kaolinite. K-agar behaves as a completely dissociated colloidal electrolyte. The clays show varying degrees of dissociation according to the extent of neutralization. No interionic effects were found between K-ions associated with the clays and those added in true solution as salts.

1647 541.141

Decomposition of hydrogen peroxide by sodium nitroprusside. LAL, B. B. *Proc. Indian Acad. Sci. A*, 14, *pp.* 652–669, *Dec.*, 1941.—The photochemical after-effect in the reaction is due to the photo-formation of Na aquopentacyanoferrate (A). Pre-insolated nitroprusside continues to react in the dark in the manner indicated by the after-effect. Addition of ferrocyanide causes the reduction of (A) to aquopentacyanoferrite, which decomposes H_2O_2 with a high velocity. The validity of the suggested mechanism for the after-reaction was tested by the effect of KCN and $NaNO_2$ which were shown to suppress the after-effect by converting (A) to ferrocyanide and nitroprusside, respectively. (A), prepared in the laboratory and added to H_2O_2-uninsolated nitroprusside mixture in the dark in presence and absence of ferrocyanide, reproduces the observations obtained by insolation. N. M. B.

1648 541.141.1 : 535.37 = 3

Association energy in the molecule HgICl. WIELAND, K. *Helv. Phys. Acta*, 14, 7, *pp.* 549–551, 1941.

1649 541.147.7 : 77

Investigations concerning practical sensitometry of photographic papers. ROMER, W., AND RAJSKI, W. *Photogr. J.*, 82, *pp.* 66–73, *March*, 1942.—The definitions of the characteristics to be measured are fixed after a discussion of the literature of photographic-paper sensitometry. An instrument for measuring the defined values is described and the practical value of the figures obtained is confirmed. The influence of ultra-violet absorption in some forms of enlarging apparatus is discussed. A. H.

1650 541.18 : 541.8

Studies on solubilization. MERRILL, JR., R. C., AND MCBAIN, J. W. *J. Phys. Chem.*, 46, *pp.* 10–19, *Jan.*, 1942.—Solubilization is defined as spontaneous formation of thermodynamically stable colloidal particles of detergent and otherwise insoluble material. Data on solubilization of 2 water-insoluble dyes, Yellow AB and Orange OT, by 28 pure and commercial detergents are discussed. Experiments on the solubilization of liquids and on the passage of solubilized dyes through semipermeable membranes have distinguished this phenomenon from emulsification and from suspending or protective action, respectively. Hydrotropy, the formation of a molecular compound, and true solution in the micelle are unacceptable as explanations of solubilization. For insoluble substances, sorption on the exterior of the micelle is possibly only a minor factor. In some cases solubilization consists in the formation of mono- and poly-molecular layers within the lamellar micelle.

1651 541.18.041.5

Silica and the Liesegang phenomenon. COPISAROW, A. C., AND COPISAROW, M. *Nature, Lond.*, 149, *p.* 413, *April* 11, 1942.

1652 541.18.043

Ultracentrifugal analysis of pepsin-treated serum globulins. PETERMANN, M. L. *J. Phys. Chem.*, 46, *pp.* 183–191, *Jan.*, 1942.

See Abstr. 1570 541.18.043 : 616.2 : 537.363

1653 541.182.04

The influence of shaking upon the thixotropic sol-gel transformation. HELLER, W., AND ROEDER, H. L. *Trans. Faraday Soc.*, 38, *pp.* 191–194, *May*, 1942.—The setting-time of thixotropic systems changes after shaking for a few min. or a few hr., depending on the stability of the systems. The setting-time of thixolabile systems changes after shaking for a few sec. The alteration by shaking is attributed to a mechanical coagulation. The formation of strongly anisometric aggregates by shaking does not lead to rheopexy but to the opposite effect.

1654 541.182.4 = 3

On the production of fibres from casein. KÜNTZEL, A., AND DOEHNER, K. *Kolloid-Beih.*, 52, *pp.* 1–44, *Oct.* 29, 1940.—[See Abstr. 593 (1942)]. Precipitation and preparation methods are critically examined and iso-electric precipitation is recommended. Ageing is a swelling process of the sodium caseinate. By adding Na_2SO_4 to the solution, the ageing time and the decomposition of casein are reduced. Curves are given showing elongation and double refraction as functions of load. They resemble those for natural wool. A definite X-ray diagram was not obtainable. R. N.

1655 541.182.5

Constitution of 3-dimensional polymers and the theory of gelation. FLORY, P. J. *J. Phys. Chem.*, 46, *pp.* 132–140, *Jan.*, 1942.—In 3-dimensional polymerizations, gelation is due to the formation of network structures of indefinite extent. These appear when the degree of branching or cross-linking of the polymer chains exceeds a critical value. After gelation, the sharp distinction between gel and sol is analogous to the demarcation between a liquid and its

saturated vapour. Observed average mol. wts. of 3-dimensional polymers must be interpreted with caution, owing to the peculiarity of the distribution of species in the vicinity of the gel point. Applications of the theory to raw rubber, protein gels, and inorganic gels are discussed.

1656 541.182.5

Wood-water relationships. VII. Swelling pressure and sorption hysteresis in gels. BARKAS, W. W. *Trans. Faraday Soc.*, 38, *pp.* 194–209, *May*, 1942.—[Abstr. 2507 (1941)]. It is shown that the pressures exerted by gels when prevented from swelling freely are different from those exerted by solutions, and exact equations are derived from the swelling pressure of a gel at both const. and varying moisture contents. Where the natural swelling induces shear stresses in the gel, if the material be plastic, hysteresis in the (vapour-pressure/moisture-content) isothermal must result; plasticity may be the cause of this phenomenon.

1657 541.182.5 = 3

Disperse structure of solid crystal systems. BALAREW, D. *Kolloid-Beih.*, 51, *pp.* 123–140, *March* 12, *and* 52, *pp.* 45–56, *Oct.* 29, 1940.—[See Abstr. 1976 (1940)]. Many fundamental problems of colloidal systems may be explained by reference to corresponding crystal systems, e.g. the binding of water, effects of temperature, pressure, irradiation and electric forces, chemiluminescence [see Abstr. 4402 (1934)], etc. Some objections raised against the theory are refuted and Kossel's theory is criticized. R. N.

See Abstr. 1628 541.182.5 : 539.26

1658 541.182.6

The hydration of colloidal sulphur. BOLAM, T. R., AND TRIVEDI, A. K. M. *Trans. Faraday Soc.*, 38, *pp.* 140–147, *April*, 1942.—The micelles in Odén sulphur sols are hydrated, probably owing to the presence of bound polythionate ions and the compensating cations. Reversible coagulation (Li and Na salts) is accompanied by partial dehydration, and irreversible coagulation (K and Ba salts) by complete dehydration of the micelles. The adsorption of chloride ions by the micelles in undialysed Odén sols is inappreciable.

1659 541.182.6 : 535.34

The absorption of light by gold sols containing acacia gum and sodium chloride. LLOYD, R. V., AND EVANS, D. P. *Trans. Faraday Soc.*, 38, *pp.* 179–186, *May*, 1942.—A method is described for the preparation of standard red gold sols by mixing certain volumes of 2 red sols prepared by reduction of $HAuCl_4$ with formalin. The required volumes are calculated from the values of the absorption densities of the sols for red light. These standard sols have a similar distribution of particle size. The percentage of red light absorbed by 10 cm.^{3} samples of a std. sol containing varying amounts of acacia gum and 1 cm.^{3} of *N* NaCl solution, varies along a smooth curve with the conc. of gum, until the latter falls to a critical value at which the sol breaks and the gold particles are slowly precipitated. At this point the curve also exhibits a sharp break, and the corresponding gum conc. can be read off from the graph.

1660 541.182.63 = 3

On the gold sol. I. Instability phenomena with gold sol. KRUYT, H. R., AND VOGEL, J. G. *Kolloid-Beih.*, 52, *pp.* 87–164, *Nov.* 30, 1940.—The electric disintegration method was modified by reversing the polarity of the electrodes every 20 sec. to ensure a stable and uninterrupted disintegration. Within 3–6 hr. a gold conc. of 0·3% was reached, which is the highest obtainable by this method. Other means of increasing the conc. are discussed. The sol particles are at first amicromic, but a coarsening takes place, indicated by increase of the Tyndall effect and sedimentation, which is different from ordinary flocculation, and explained by local discharges in the double layer. Only halogenous compounds initiate the coarsening. R. N.

See Abstr. 1543 541.182.63 : 535.5 : 535.43

See Abstr. 1646 541.182.63 : 545.37 : 541.135.5

1661 541.182.63.04

Properties of the floc in water purifications with bentonite. BEAVERS, E. M., AND CAMERON, F. K. *J. Phys. Chem.*, 46, *pp.* 93–98, *Jan.*, 1942.—Microscopic study of floc formation in bentonite sols confirmed previous conclusions. Flocs formed from suspensions of small average particle size are less dense (more highly solvated) and larger than those formed from suspensions of greater particle size. Desolvation of individual particles would greatly increase floc density, decrease floc size, and increase rate of settling.

1662 541.183.2

The van der Waals sorption of chlorine by silica gel at low temperatures, and of gaseous hydrogen chloride, hydrogen bromide, and hydrogen iodide by silica gel. REYERSON, L. H., AND BEMMELS, C. *J. Phys. Chem.*, 46, *pp.* 31–42, *Jan.*, 1942.—The results of these measurements agree with the theory of Brunauer [see Abstr. 1886 (1935), 2584 (1940)].

1663 541.183.2

The sorption of soluble dyes by gelatin. SHEPPARD, S. E., HOUCK, R. C., AND DITTMAR, C. *J. Phys. Chem.*, 46, *pp.* 158–176, *Jan.*, 1942.—Gelatin is found to take up dye from relatively dilute solutions of soluble acid and basic dyes accordingly to a reversible reaction between protein cation and dye anion for the former, and protein anion and dye cation for the latter. The binding is by electrostatic forces, and the equilibrium or distribution of the dye between the bath and the gel is governed (i) by the *p*H, (ii) by the neutral salt content, and (iii) by the conc. of the dye, according to the Donnan membrane equilibrium. Swelling of the dye protein is antibat to dyeing. It is probable, as suggested by Elöd for wool, that excess dye acts as a neutral salt, exercising a levelling effect as the total ionic strength is increased. This is probably the reason why the behaviour pattern in dyeing becomes less evidently in accord with the Donnan equilibrium in conc. dye solutions, although other complications may supervene because of aggregation of the dye in polymolecular ions. These complications are largely avoided in the experiments reported. H. H. HO.

1664 541.2 = 4

Classification of atomic masses. JAQUEROD, A. *Helv. Phys. Acta*, 14, 7, *pp.* 606–617, 1941, *and* 15, 1, *pp.* 74–84, 1942.

See Abstr. 1559 541.24 : 536.423

1665 541.25

Molecular volume of liquid alkanes at corresponding temperatures. EGLOFF, G., AND KUDER, R. C. *Industr. Engng Chem.*, 34, *pp.* 372–373, *March*, 1942.

See Abstr. 1447 541.25 : 518.3

1666 541.452 = 3

On properties, formation and structure of heteropolar compounds. JAHR, K. F. *Naturwissenschaften*, 29, *pp.* 505–514, *Aug.* 22, and *pp.* 528–533, *Aug.* 29, 1941.—A progress review of research on heteropolar acids from investigations in aqueous solutions and X-ray structure analyses of solid compounds. Over 100 references are given. H. G. S.

See Abstr. 1532 541.65 : 535.338

1667 541.651.22 = 3

On the effect of substituents at olephinic carbon atoms on the physico-chemical properties of the chromophore groups vinylene and divinylene. HERTEL, E., AND HOFFMANN, K. A. *Z. phys. Chem. B*, 50, *pp.* 382–402, *Nov.*, 1941.—[See Abstr. 182 (1940)]. Changes caused by various substituents on the distribution of charges within the vinylene and divinylene groups are investigated. A simple relation between polarity, conductivity and position of absorption range of the group could not be established. Basicity and reaction velocity and their mutual relation were investigated. Both vinylene and divinylene groups are uniform chromophores, the first diatomic and the second tetratomic, but not able to form a uniform chromophore with the polyatomic phenyl group. Olephinic and aromatic groups absorb the light independently from each other. Light absorption of the vinylene group does not change its inductive effect. The effect of the solvent on the absorption range is attributed to residual valency forces. R. N.

See Abstr. 1513 541.68 : 534.22

See Abstr. 1568 541.8 : 539.133 : 537.226.2

See Abstr. 1650 541.8 : 541.18

1668 541.9 = 3

Completion and extension of the periodic system. STRASSMANN, F. *Naturwissenschaften*, 29, *pp.* 492–496, *Aug.* 8, 1941.—Discusses several elements, such as 75, 43, 61, 85, 87, etc., in relation to the periodic system. H. G. S.

1669 542.8 : 612.1

The electrolytic separation of radioactive iron from the blood. ROSS, J. F., AND CHAPIN, M. A. *Rev. Sci. Instrum.*, 13, *pp.* 77–80, *Feb.*, 1942.—A technique for electro-deposition of radioactive iron from the blood is described. This method allows accurate and reproducible estimation of radioactive iron in biological materials.

1670 543.9 = 3

Detection and measurement of small concentrations of free oxygen (up to 1 : 10^{10}) by means of luminous bacteria. MEYER, K. P. *Helv. Phys. Acta*, 15, 1, *pp.* 3–22, 1942.—Previous work in this field is outlined, and experimentally sensitive methods are described, which have enabled the detection of minute quantities of O_2 of the order of 1 : 10^{10}. The description is accompanied by full details of apparatus and technique for obtaining the cultures of the luminous bacteria and for their observation. The data obtained by Eymers and Schouwenburg (*Enzymologia*, 1, 107, 1936/37; 1, 328; 3, 235, 1937) for the light emission of the luminous bacteria are found to compare favourably with the sensitivity of the O_2 detection. H. H. HO.

1671 545.2

Determination of the carboxyl group content of cellulose and oxycellulose. HEYMANN, E., AND RABINOV, G. *Trans. Faraday Soc.*, 38, *pp.* 209–213, *May*, 1942.

See Abstr. 1646 545.37 : 541.182.63 : 541.135.5

CRYSTALLOGRAPHY

1672 548 : 531.7 : 669

The lattice spacings of the primary solid solutions in magnesium of the metals of Group III B and of tin and lead. RAYNOR, G. V. *Proc. Roy. Soc. A*, 180, *pp.* 107–121, *March* 18, 1942.—Measurement data confirm that the effect of increasing the valency of the solute is to tend to expand the lattice of Mg. Although the inter-atomic distance for Sn is smaller than the corresponding distances for In and Tl, the contraction in the "*a*"-spacing of Mg-Sn alloys is markedly less than in the In and Tl alloys. Pb expands the lattice of Mg. The "*a*"-spacing-composition curves are smooth and continuous. The "*c*"-spacing curves show a change in direction at an electron conc. of approx. 2·0075, that is, at 0·75 atom. % of a 3-valent solute and 0·375 of a 4-valent solute. At this point an overlap of electrons from the first Brillouin zone for the Mg structure occurs in the "*c*" direction. For solutes of favourable "size factor" the variation in axial ratio with composition, after the onset of the second overlap, is $\propto$ to the electron conc. The apparent atomic diameters of the above elements in dilute solid solution in Mg agree with the Brillouin-zone theories. In, Tl, Sn and Pb, are incompletely ionized in the elementary state.

1673 548:531.71 : 669.1

The lattice spacings and crystal structure of cementite. HUME-ROTHERY, W., RAYNOR, G. V., AND LITTLE, A. T. *J. Iron Steel Inst.*, [7 *pp.*], 1942. *Advance copy.*—Cementite was extracted by electrolytic attack from 3 steels of different compositions, and the lattice spacings were determined by Debye–Scherrer photographs in a 19 cm. camera. No difference could be detected between the lattice spacings of the different samples, and the analysis of one of them confirmed the composition Fe_3C. The structure is discussed.

See Abstr. 1575–1578 548 : 535.3 : 537.531

1674 548 : 535.338

Fluorescence, absorption and scattering of light in ruby. MANI, A. *Proc. Indian Acad. Sci. A*, 15, *pp.* 52–64, *Jan.*, 1942.—The first-order lattice spectrum of alumina possesses 18 normal modes of vibration. Two Raman lines having frequency shifts of 376 and 412 cm.$^{-1}$ are obtained with a single crystal of alumina. Fluorescence and absorption spectra of ruby are recorded, using specially sensitized infra-red plates to register the bands in the long-wavelength region. The polarization characters of the bands are studied with reference to the direction of the optic axis, and the bands are classified into 2 groups—electronic and vibrational bands. The frequency shifts of 8 of the vibrational bands from the principal

doublets agree with one or the other of the observed Raman and infra-red frequencies of alumina. The polarization characters of the bands on the Stokes sides are also in good agreement with those of the corresponding bands on the anti-Stokes side. A. H.

See Abstr. 1533 548 : 535.338

1675 548 : 536.631

The thermal energy of crystalline solids: basic theory. RAMAN, C. V. *Proc. Indian Acad. Sci. A*, 14, *pp.* 459–467, *Nov.*, 1941.—A new theory of the sp. ht. of crystals is given. The possible vibrations of the atoms in a crystal can be divided into 2 groups, those occurring on a macroscopic scale and those of the lattice and superlattice. The thermal energy associated with macroscopic vibrations appears as a continuous spectrum and is negligible. The main thermal energy is associated with the lattice frequencies which appear as monochromatic lines in the infra-red spectrum and the residue with the superlattice frequencies which are also monochromatic. The latter appears in the remote infra-red, and the Einstein term they contribute to the sp. ht. is relatively important only at low temperatures. Spectroscopic evidence supports these ideas. The sp. ht. theories of Debye and of Born are critically examined, the assumptions on which they are based are theoretically unjustifiable and lacking in experimental confirmation. R. W. P.

1676 548 : 536.631

The thermal energy of crystalline solids: white phosphorus. NORRIS, R. *Proc. Indian Acad. Sci. A*, 14, *pp.* 468–472, *Nov.*, 1941.—The sp. ht. of solid P is calculated by considering the unit cell of $4P_4$ molecules having 48 degrees of freedom. Of these 45 are identified with discrete frequencies of the infra-red spectrum and hence appear as Einstein terms in the sp. ht. expression. The remaining 3 corresponding to the simple translations of the unit cell in the lattice are assumed to contribute another Einstein term. Calculated values agree with sp. ht. data. R. W. P.

1677 548 : 536.631

The thermal energy of crystalline solids: lithium, tungsten, gold, silicon and grey tin. DAYAL, B. *Proc. Indian Acad. Sci. A*, 14, *pp.* 473–483, *Nov.*, 1941.—The sp. ht. formula for all metals is shown to require 2 Einstein terms, 1 corresp. to the lattice frequencies and the other to the superlattice frequencies. Body-centred cubic lattices, face-centred cubic lattices and diamond-like structures have, respectively, 1, 3 and 7 lattice frequencies, but the last 2 can be represented by 1 and 2 respesentative frequencies, respectively. Sp. hts. of Li, W, Au, Si and grey Sn calculated in the above manner all agree with experiment. R. W. P.

1678 548 : 536.631

Thermal energy of crystalline solids: diamond. ANAND, V. B. *Proc. Indian Acad. Sci. A*, 14, *pp.* 484–491, *Nov.*, 1941.—Using the new theory and infra-red spectral data, sp. hts. of diamond are calculated. The values agree with Pitzer's experimental results.

R. W. P.

1679 548 : 536.631

Thermal energy of crystalline solids: magnesium, zinc and cadmium. DAYAL, B. *Proc. Indian Acad. Sci. A*, 14, *pp.* 492–498, *Nov.*, 1941.—The sp. hts. of these metals of hexagonal structure is calculated by taking 2 lattice frequencies, the lower of which is given 1 and the higher 2 degrees of freedom. Einstein terms corresponding to superlattice frequencies of rapidly diminishing weight are also included. Calculations made in this way for Mg, Zn and Cd agree with experimental results. R. W. P.

1680 548 : 536.631

Thermal energy of crystalline solids: quartz. NORRIS, R. *Proc. Indian Acad. Sci. A*, 14, *pp.* 499–505, *Nov.*, 1941.—Failure of the Debye theory to explain the sp. ht. of quartz at low temperatures is discussed; values in accord with Anderson's experimental results are obtained by including Einstein's terms corresp. to the superlattice frequencies of 145 and 69 $cm.^{-1}$, for which feeble lines had been observed in the Raman spectra of quartz. R. W. P.

1681 548 : 536.631

Thermal energy of crystalline solids: alkali halides. VENKATESWARAN, C. S. *Proc. Indian Acad. Sci. A*, 14, *pp.* 506–515, *Nov.*, 1941.—A general expression is derived for the thermal energy of cubic lattices of the rock-salt type in terms of the lattice and superlattice frequencies. It is evaluated for NaCl (10° to 300°K.) and KCl (3° to 285°K.), 2 of the lattice frequencies of KCl being given by the infra-red spectrum and the others being deduced from those of NaCl. The calculated values agree with experiment.

R. W. P.

1682 548 : 537

Electric breakdown of ionic crystals. FRÖHLICH, H. *Phys. Rev.*, 61, *pp.* 200–201, *Feb.* 1 *and* 15, 1942.—[See Abstr. 997 B and 1658 (1941)].

1683 548.5

Some methods for the preparation of large protein crystals. BAILEY, K. *Trans. Faraday Soc.*, 38, *pp.* 186–191, *May*, 1942.—Methods for obtaining large protein crystals of edestin, castor seed globulin and excelsin are described. Methods for the production of ovalbumin and muscle albumin crystals, having a high length/width ratio, and suitable for orientation by streaming when used in X-ray diffraction studies, are outlined.

See Abstr. 1631 548.5 : 536.75 : 539.371

See Abstr. 1579 548.73 : 535.3 : 537.531

1684 548.73 : 536.4 : 539.214

Molecular structure and rubber-like elasticity. I–III. BUNN, C. W. *Proc. Roy. Soc. A*, 180, *pp.* 40–99, *March* 18, 1942.—Full details of the crystal structure of β gutta-percha, rubber and polychloroprene, as determined by X-ray diffraction photographs, are reported. The staggered bond configuration favoured in molecules containing 2 or more singly linked C atoms suggests a general "principle of staggered bonds." The prediction of molecular configurations on this basis is discussed. The principle applies also to molecules containing singly linked N, O and S atoms and may be operative in molecules containing double bonds. The non-planar chain forms of gutta-percha, rubber and polychloroprene are attributed to the principle of staggered bonds and to the repulsion between CH_3 or Cl side substituents and particular CH_2 groups in the chains. Melting is ascribed to the onset of chain-bond oscillations between alternative geometrically equivalent positions, and the low m.p. of the above substances to the greater

freedom of rotation round the single bonds. The energy required for this rotation is ascribed to the bond-orientation energy and to the interaction of the atoms or groups held by the bonds. The melting of rubber and like polymers is discussed on this basis and the structure and melting of amorphous rubber are considered. N. M. B.

1685 548.73 : 536.63 : 539

New concepts of the solid state. RAMAN, C. V. *Curr. Sci.*, 11, *pp.* 85–92, *Feb.*, 1942. *Proc. Indian Acad. Sci. A*, 15, *pp.* 65–72, *Feb.*, *id. B*, 15, *pp.* 75–82, *Feb.*, 1942.—The postulates on which the Debye theory of the sp. ht. of solids and the Born crystal dynamics are respectively based are critically examined and shown to be theoretically untenable.

See Abstr. 1630 548.73 : 539.262

GEOPHYSICS

1686 550.3

Geophysical measurements in the laboratory and in the field. MCCOMB, H. E. *J. Wash. Acad. Sci.*, 32, *pp.* 65–79, *March* 15, 1942.—Deals briefly with physical measurements in geomagnetism and seismology, describes instruments and methods used and compares results obtained in the laboratory with results obtained in the field.

1687 550.3

Geophysics in war. HEILAND, C. A. *Min. Mag.*, 32, *pp.* 65–70 *and* 86, *Feb.*, 1942.—A comprehensive descriptive account. Direct war applications include gun sound ranging by multiple microphones; binaural location of aircraft; submarine sound detection; sonic and ultrasonic echo sounding at sea, including wreck location. Indirect uses include geophysical prospecting, covering electrical resistivity, for location of water, petroleum, mineral ores, etc. E. H. W. B.

1688 550.312

The density variation of the earth's central core. BULLEN, K. E. *Bull. Seism. Soc. Amer.*, 32, *pp.* 19–29, *Jan.*, 1942.—The analysis [Abstr. 2940 (1940)] is extended to the earth's central core. Between the outer boundary of the core and a distance of 1400 km. from the earth's centre the density ranges from 9·4 g./cm.^{3} to 11·5 g./cm.^{3} within an uncertainty of 3%. The density and pressure figures are compatible with the existence of fairly pure iron in this part of the earth. Values of the density within 1400 km. of the centre are subject to a wide margin of uncertainty. Figures are included for the variation of gravity and the distribution of pressure within the central core.

1689 550.34

The Olympic earthquake of November 13, 1939. COOMBS, H. A, AND BARKSDALE, J. D. *Bull. Seism. Soc. Amer.*, 32, *pp.* 1–6, *Jan.*, 1942.

1690 550.34

Earthquake near Whittier, California, January 29, 1941. RICHTER, C. F. *Bull. Seism. Soc. Amer.*, 32, *pp.* 7–9, *Jan.*, 1942.

1691 550.34

Earthquakes of the north-eastern United States and Eastern Canada, 1938, 1939, 1940. LINEHAN, D., AND LEET, L. D. *Bull. Seism. Soc. Amer.*, 32, *pp.* 11–17, *Jan.*, 1942.

See Abstr. 1515 550.341 : 534.647

1692 550.42 : 539.16

The distribution of helium and radioactivity in rocks. III. Radioactivity and petrology of some California intrusives. LARSEN, E. S., AND KEEVIL, N. B. *Amer. J. Sci.*, 240, *pp.* 204–215, *March*, 1942.—[See Abstr. 2608 (1940)]. He and radioactivity determinations were made on minerals separated from 3 fresh specimens. The radioactivity of the accessory minerals is from 100 to 1000 times higher than those of common rock minerals. The assignment of Jurassic age is the most consistent with the corrected He age determinations and with field data.

See Abstr. 1592 550.87 : 537.59

See Abstr. 1506 551.25 : 551.463 : 551.510.3 : 536.412 : 532.77

See Abstr. 1699 551.311.12 : 551.524.3

See Abstr. 1506 551.463 : 551.510.3 : 536.412 : 551.25 : 532.77

See Abstr. 1494 551.465 : 551.515.11 : 532.5

See Abstr. 1700 551.506.3

1693 551.506.8

Report on the phenological observations in the British Isles from Dec., 1940, to Nov., 1941. GUNTON, H. C. *Quart. J. Roy Met. Soc.* (*Phenol. Rep.*), 68, *pp.* 89–119, 1942.

1694 551.509.33

Forecasting the "Northeast monsoon" rainfall of South Madras. IYER, V. D. *Sci. Notes India Met. Dep.*, 8, 98, *pp.* 147–154, 1941.—The paper investigates the possibility of evolving a forecasting formula from previous weather conditions. A selection of likely factors is made and 3 regression formulae are evolved. A formula based on (1) S. American pressure from June to Aug., (2) Bangalore westerly upper winds from 3 to 5 km. in Sept. and (3) Agra westerly upper winds from 5 to 8 km. in Sept., is found to give a significant multiple correlation coefficient of 0·60. A formula based on the same factors gives similar results when applied to south-east Madras alone.

See Abstr. 1506 551.510.3 : 536.412 : 551.25 : 551.463 : 532.77

1695 551.510.42 = 3

Atmospheric clouding due to desert dust and driven snow. MÖRIKOFER, W. *Helv. Phys. Acta*, 14, 7, *pp.* 537–548, 1941.—The light absorption due to clouds of Sahara dust in the upper atmosphere of Davos has been investigated on 5 occasions in the period 1935–41 by pyrheliometer measurements. Direct solar radiation is reduced by 10–20% (exceptionally by > 30%); but there is a corresponding increase in the intensity of scattered sky radiation, so that total radiation is reduced only by 5–10%. There is no dependence of absorption on wavelength. Similar observations on driven snow in the atmosphere give a reduction in direct radiation which is wholly made up by an increase in diffused light; this absorption is confined to the red and infra-red regions of the spectrum. A. HU.

1696 551.513.2

Fronts and frontogenesis in relation to vorticity. PETTERSSEN, S., AND AUSTIN, J. M. *Pap. Phys.*

Oceanogr. Met., Massachusetts, 7, *pp.* 7–37, *Jan.*, 1942.—A number of general frontal characteristics are investigated dynamically, in particular the cyclonic vorticity, which is shown not to be uniquely determined by the density discontinuity. The formation of cyclonic wind shear at a front is considered; vorticity is shown not to be a conservative property, its variation depending mainly on divergence and only to a lesser degree on solenoids. Examples are given to show how the vorticity field can be constructed from ordinary weather maps. A. HU.

See Abstr. 1494 551.515.11 : 551.465 : 532.5

1697 551.521.1

Solar radiation and sunspot data for November, 1941. CULLINANE, H., AND PAINE, I. *Mon. Weath. Rev., Wash.*, 69, *pp.* 347–349, *Nov.*, 1941.

1698 551.521.3 = 3

On the atmospheric transmission of solar radiation at 2 144 Å. MEYER, E. *Helv. Phys. Acta*, 14, 7, *pp.* 625–632, 1941.—The possibility of detecting solar radiation between the O_3 and O_2 absorptions in the ultra-violet is re-examined, allowing for the facts that O_2 absorption does not follow Beer's law and that it is affected by the N_2 of the atmosphere. It is shown that at the elevation of the Jungfraujoch a simple quartz monochromator used perpendicular to the radiation should receive 439 light quanta per min. at 2 144 Å. A. HU.

1699 551.524.3 : 551.311.12

Air temperature and the growth of glaciers. CALLENDAR, G. S. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 57–60, *Jan.*, 1942.

1700 551.524.3 551.506.3

Serial monthly values of mean temperature over the British Isles, 1881–1940, and annual values 1866–1940. GLASSSPOOLE, J., AND HOGG, W. H. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 45–55; *Disc.*, 55–57, *Jan.*, 1942.

1701 551.524.34

Secular trend of temperature at Oxford. LEWIS, L. F. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 61–62, *Jan.*, 1942.

1702 551.524.7 = 3

On the temperature of the uppermost atmospheric layers. REGNER, E. *Naturwissenschaften*, 29, *pp.* 479–484, *Aug.* 8, 1941.—From observations of a general nature the author attempts an explanation of the elevated temperature of the upper layers and considers its determination from spectral investigations. H. G. S.

1703 551.573 : 551.579

Evaporation-loss per month over drainage areas. III. Curvilinearity in relationship to rainfall of the same month and influence of previous rainfall. LLOYD, D. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 35–40; *Disc.*, 40–43, *Jan.*, 1942.—Evidence is brought forward of curvilinearity in the partial relation between evaporation loss and the period rainfall; this is shown by diagrams. The joint functional causation of rainfall and temperature is further advanced. It is inferred statistically that rain experienced in 3 previous months augments run-off and influences the value of apparent loss to a small extent (amounts are stated), but not sufficiently to alter the relations of evaporation loss produced in the first and second papers. [Abstr. 548 (1941)].

1704 551.577.36

Rainfall frequency at Patiala. MAHAJAN, L. D. *Curr. Sci.*, 11, *pp.* 62–64, *Feb.*, 1942.

See Abstr. 1703 551.579 : 551.573

1705 551.582

Meteorological and climatological data for Nov., 1941. *Mon. Weath. Rev., Wash.*, 69, *pp.* 332–347, *Nov.*, 1941.

1706 551.582.3

Climatological data. GRAY, R. W. *Climatol. Data, W. Indies*, 20, *pp.* 33–48, *May–June*, 1940.

1707 551.582.3

Climatological data. GRAY, R. W. *Climatol. Data, W. Indies*, 20, *pp.* 49–56, *July*, 1940.

1708 551.582.3

Climatological data. GRAY, R. W. *Climatol. Data, W. Indies*, 21, *pp.* 27–32, *April*, 1941.

1709 551.594.2 = 4

A theory of the mechanism of the lightning stroke. SZPOR, S. *Bull. Ass. Suisse Élect.*, 33, *pp.* 6–15, *Jan.* 14, 1942.—A new theory to explain the progression of the leader stroke and the concentration of the lightning channel is advanced and the possibility of the initiation of the discharge by rain drops is discussed. Electrostatic considerations, based on the short-circuiting of the original electric field by the lightning channel, and electromagnetic considerations, taking into account the growth of current in the channel and the resulting voltage drops, lead to numerical relations between various parameters of the leader discharge, i.e. its length and dia., the magnitude and distribution of charge along the channel, the field distribution in front and behind the tip, the velocity of propagation, the current magnitude, and the cloud potential. The stepped-leader process is explained by a reduction of the potential gradient in front of the leader tip due to the voltage drop along the channel, and the effect of polarity is investigated. Calculated values and observations agree. R. H. G.

VARIOUS SUBJECTS

See Abstr. 1581	58 : [537.531.9 + 539.185.9
See Abstr. 1583	58 : 537.533.72
See Abstr. 1669	612.1 : 542.8
See Abstr. 1580	615.849 : 537.531
See Abstr. 1570	616.2 : 541.18.043 : 537.363
See Abstr. 1672	669 : 531.7 : 548
See Abstr. 1673	669.1 : 531.71 : 548
See Abstr. 1629	669.1 : 539.26
See Abstr. 1639	669.1 : 539.434
See Abstr. 1634	669.18 : 539.389 : 539.4.016
See Abstr. 1619	669.7 : 539.215.4
See Abstr. 1521	77 : 535.319
See Abstr. 1649	77 : 541.147.7